COMMENTS BY IDAHO WATER USERS
ON THE
DRAFT BIOLOGICAL OPINION
FOR
OPERATION OF THE FEDERAL COLUMBIA RIVER POWER SYSTEM INCLUDING THE JUVENILE FISH TRANSPORTATION PROGRAM AND THE BUREAU OF RECLAMATION'S 31 PROJECTS, INCLUDING THE ENTIRE COLUMBIA BASIN PROJECT

ISSUED JULY 27, 2000
BY
NATIONAL MARINE FISHERIES SERVICE, NORTHWEST REGION

COMMENTS SUBMITTED ON BEHALF OF

THE COMMITTEE OF NINE
AND
THE IDAHO WATER USERS ASSOCIATION

SEPTEMBER 21, 2000

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These comments are submitted on behalf of the Committee of Nine and the Idaho Water Users Association ("Idaho water users") and are directed to the Draft Biological Opinion dated July 27, 2000 for *Operation of the Federal Columbia River Power System Including the Juvenile Fish Transportation Program and the Bureau of Reclamation's 31 Projects, Including the entire Columbia Basin Project* issued by National Marine Fisheries Service, Northwest Region ("Draft BiOp").

The Committee of Nine is the official advisory committee for Water District 1, the largest water district in the State of Idaho. Water District 1 is responsible for the distribution of water among appropriators within the water district from the natural flow of the Snake River and storage from U.S. Bureau of Reclamation ("BOR") reservoirs on the Snake River above Milner Dam. The Committee of Nine is also a designated rental pool committee that has facilitated the rental of stored water to the BOR to provide water for flow augmentation pursuant to the 1995 Biological Opinion. The Idaho Water Users Association was formed in 1938 and represents about 300 canal companies, irrigation districts, water districts, agri-business and professional organizations, municipal and public water suppliers, and others. These comments have been prepared with the assistance of the scientists, biologists, and engineers who have been retained to address Upper Snake River issues involving the Endangered Species Act ("ESA").[1]

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[1] Contributors include: Dr. James J. Anderson, School of Fisheries, University of Washington; Craig L. Sommers and David B. Shaw, ERO Resources Corporation; Dr. Richard A. Hinrichsen, Hinrichsen Environmental Services; Dr. William J. McNeil, retired professor of fisheries, Oregon State University. These individuals also contributed to comments by the Idaho water users on the draft White Paper on flow (10/29/99), the draft All-H Paper (3/16/00) and the draft Feasibility Report/Environmental Impact Statement (3/31/00). Résumés of the contributors are provided in Attachment 3.

SUMMARY OF COMMENTS

The Draft BiOp raises numerous issues. However, the Idaho water users have focused their comments on the specific set of issues pertaining to flow augmentation from the Upper Snake River.[2]

As an overriding issue, there is no need for consultation on the Upper Snake BOR projects. The contractual obligations and operation of these projects have not changed significantly since prior to the passage of the ESA in 1973. Moreover, there have been no changes since the last BiOp on these projects issued in December 1999.

The Draft BiOp violates the ESA by failing to identify the actions of specific projects that cause jeopardy to the listed species or adversely affect their habitat. The 43 projects encompassed by the Draft BiOp are not all interrelated or interdependent. At the very least, the Upper Snake BOR projects must be treated individually or collectively in the BiOp or in a separate consultation.

Flows from the Upper Snake River have slightly increased over the past 89 years, especially during the critical summer months, even with irrigation development in southern Idaho and the construction of the Upper Snake Bureau of Reclamation projects.[3] This development and construction occurred long before the populations of the listed species declined to endangered or threatened levels. Thus, water development in the Upper Snake in general, and the Upper Snake BOR projects in particular, did not alter flows so as to cause jeopardy to the listed species or adverse effects on their habitat.

There is no scientific foundation for conclusions in the Draft BiOp that Upper Snake flow augmentation will provide biological benefits for the listed species. The purported flow/survival relationship for fall chinook above Lower Granite is unfounded and there is evidence that flow augmentation from the Upper Snake BOR projects is actually detrimental to the listed species. Likewise, there are no demonstrated benefits from

[2] Throughout these comments, the Upper Snake River ("Upper Snake") means the portion of the basin above Brownlee Reservoir.

[3] In fact, increased summer flows are the result of return flows from Upper Snake irrigation.

Upper Snake flow augmentation through the hydropower system, in the estuary, or in the ocean plume for any of the listed species.

Flow augmentation from the Upper Snake has previously been an interim or experimental measure aimed at mitigating the jeopardy and incidental take caused by the Federal Columbia River Power System (FRCPS). There is no basis for the new conclusion in the Draft BiOp that the Upper Snake BOR projects cause jeopardy, with or without providing 427 kaf of flow augmentation. Likewise, there is no basis for the implication in the Draft BiOp that the Upper Snake BOR projects incidentally take listed species. Also, there is no explanation of how NMFS could conclude in December 1999 that the proposed operations of the Upper Snake BOR projects <u>do</u> <u>not</u> jeopardize the listed species, and then conclude six months later with no new data that the Upper Snake projects <u>do</u> contribute to the jeopardy of the species.

Because operation of the Upper Snake BOR projects does not cause jeopardy, there is no basis for the reasonable and prudent alternatives (RPAs) for these projects identified in the Draft BiOp. Specifically, the flow targets established for the mainstem are unreasonable and unfounded. Flow augmentation using 427 kaf or more water is unnecessary and illegal, especially with respect to the use of powerhead space, which is contrary to state and federal laws. The requirement for the BOR to consult on use of uncontracted space does not fully comport with federal and state law and the proposed consultations are too narrow. Likewise, the description of “unauthorized” uses does not comport with Reclamation law. Pursuit of increased water conservation and reduction of so-called unauthorized uses in the Upper Snake will not increase streamflow. Additional water should not be sought from the Upper Snake. The additional water is not needed, and a state law mechanism for providing that water downstream is unlikely. Finally, there is inadequate consideration of resident fish and wildlife needs and other impacts in continuation or expansion of Upper Snake flow augmentation. It is not reasonable and prudent to potentially harm resident species and their habitat when there is no significant benefit to the listed species from the RPAs. Moreover, because there is no jeopardy from the Upper Snake BOR projects, NMFS must comply with NEPA in taking actions with respect to these projects.

The biological, hydro, and physical performance standards set forth in the Draft BiOp are flawed. Various standards under these categories are unrealistic, not clearly defined, immeasurable, ineffective, or even detrimental to the listed species.

Harvest reforms can provide significant benefit to the listed species, especially Snake River fall chinook. The RPAs listed for harvest in the Draft BiOp should be revised to require these reforms.

The Magnuson-Stevens Act recommendations for the listed species are premature because Essential Fish Habitat has not been designated for these fish. Moreover, the scope of those recommendations is not clear; and to the extent that they apply to the Upper Snake BOR projects, they suffer from the same defects described for the Section 7 consultation.

To reiterate a central point of these comments, the Idaho water users oppose the inclusion of flow augmentation using 427,000 acre-feet or more water from the Upper Snake River as an RPA. The Draft BiOp should be revised to eliminate Upper Snake River flow augmentation because these BOR projects do not jeopardize the listed species or adversely modify their habitat. Moreover, flow augmentation provides no significant biological or physical benefits to the listed species, and indeed may be harmful.

BIOP SCOPE AND OBJECTIVES ARE FLAWED

From the outset, the Draft BiOp is on the wrong track with respect to BOR projects in the Upper Snake River basin. First, there is no duty for the BOR to consult with NMFS on the operation of the Upper Snake BOR projects because the contractual obligations and operation of those projects have not changed since enactment of the ESA listing of the species, or publication of the last BiOp on these projects. Second, assuming there is a duty to consult, the proper scope of the consultation is to ensure that <u>specific BOR actions on particular Upper Snake projects</u> will not jeopardize the continued existence of listed species or adversely modify their habitat. Rather than being lumped together with FCRPS projects and other BOR projects, the Upper Snake BOR projects should be evaluated separately given their unique circumstances. The Upper Snake BOR projects are not “interrelated or interdependent” with the FCRPS or other Columbia River basin BOR projects (50 CFR 402.02). Third, there is no basis for a jeopardy opinion on the

Upper Snake BOR projects. As a result, the RPAs for the Upper Snake projects are actually mitigation measures for the listed species. Thus, as discussed further below, the Draft BiOp violates the ESA with respect to the Upper Snake BOR projects.

The Upper Snake BOR projects have been operated and contractually obligated to provide irrigation water, and incidentally to provide power, flood control, recreation, fish and wildlife benefits, since their inception in the early 1900s. No significant changes in those operations and contracts have occurred since the final components were constructed in the 1940s and 1950s, long before the enactment of the ESA in 1973 or listing of the species in the 1990s. Thus, there are no new federal "actions" in need of consultation with NMFS. Moreover, there is no need to have reinitiated consultation when there have been no operational or contractual changes since the 1999 BiOp on these same Upper Snake BOR projects was completed in December 1999 (see discussion below under *Proposed Action*).

There is no requirement for consultation on the Upper Snake BOR projects with respect to the listed species involved in the Draft BiOp because there is no discretionary "action" that is subject to consultation. "Action" is defined as "all activities or programs of any kind authorized, funded or carried out, in whole or in part, by Federal agencies…." and include but are not limited to "(a)actions intended to conserve listed species or their habitat; (b) the promulgation of regulations; (c) the granting of licenses, contracts… (d) actions directly or indirectly causing modifications to the land, water, or air." 50 C.F.R. § 402.02. The ESA only requires action agencies to consult or confer with FWS/NFMS when there is discretionary Federal involvement or control over the "action." The storage and delivery of water under the Upper Snake BOR projects is governed by permanent contracts, not discretionary actions. For example, Attachment 2 contains an excerpt from the contract between the BOR and the Twin Falls Canal Company, a representative contract in the Upper Snake. This is a permanent contract that provides among other things that "It is the purpose of the United States and the water users…to have the reservoir system so operated as to effect the greatest practicable conservation of water" under the water rights created by the 1923 contract (see Articles 6 and 14(a)). Thus, there is no "discretionary Federal involvement or control over the action" and, therefore, there is no duty to consult. Moreover, as discussed at length below, because operation of the

Upper Snake BOR projects does not affect listed species or critical habitat, there is no duty to consult.

At most, the BOR should only engage in informal consultation with respect to the Upper Snake projects with respect to discretionary actions, if any exist. Again, given that the result of the informal consultation should be that any such actions are not likely to adversely affect the listed species or critical habitat, the consultation process should be terminated at that point.

Of course, the BOR previously sought consultation on the Upper Snake projects, which led to the 1999 BiOp. However, since there has been no new discretionary action, and there is no new information, there is no reason to reinitiate consultation.

As set forth at the outset of the Draft BiOp, the "Biological Opinion does not attempt to apportion the relative contribution of the FCRPS and BOR projects to the current status of the ESUs" (p. 1-1).[4] Rather, all 43 projects are combined in the Draft BiOp because they have "hydrologic effects on the flows in the mainstems of the Columbia and Snake rivers" (p. 1-1). This approach ignores the practical and legal differences among these projects. The FCRPS and main stem Columbia River BOR projects are relatively recent, enormous, interrelated projects operating within or near critical habitat for the listed salmon and steelhead. In contrast, the Upper Snake BOR projects are relatively small, were in existence long before the decline of the listed species to critical levels, are located far outside of critical habitat (and in many cases outside of historical habitat), and have had no significant impact on historical downstream flows.

By failing to separately consult on specific actions or at least analyze, understand, and apportion the relative effect of the projects on the species or their critical habitat, the Draft BiOp fails to conform to Section 7(b)(3)(A) of the Endangered Species Act (ESA). That section requires: "…*a written statement setting forth…a summary of the information on which the opinion is based, <u>detailing</u> how the agency action affects the species or its critical habitat"* (emphasis supplied). The Draft BiOp recognizes that these are separate, unrelated actions being consulted upon. Yet, as discussed thoroughly below, the Draft

[4] In these comments, page references refer to the Draft BiOp unless otherwise noted.

BiOp does not and cannot provide details on how BOR construction and operation of the Upper Snake projects affect the listed species or their habitat.

The Draft BiOp notes that consultation between BOR and NMFS occurred pursuant to Section 7(a)(2) of the ESA. Unfortunately, the Draft BiOp extends beyond the purpose of the consultation. Section 7(a)(2) consultation is to ensure that actions which are authorized, funded, or carried out by the BOR are not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of the critical habitat of such species. Section 7(b)(3)(A) directs the Secretary to provide to BOR a written statement setting forth the Secretary's opinion, and a summary of the information on which the opinion is based, detailing how the agency action affects the species or its critical habitat. If jeopardy or adverse modification is found, the Secretary is required to suggest those reasonable and prudent alternatives that he believes would not violate Section 7(a)(2). As discussed below, jeopardy to listed species or adverse modification has never previously been determined by the Secretary for the Upper Snake BOR projects. Indeed, just the opposite is true.

In summary, the Draft BiOp should be revised to eliminate the Upper Snake BOR projects. If included in the Draft BiOp, the effects of the Upper Snake BOR projects on the listed species and their habitat should be specifically addressed, or separate analyses should be conducted on these projects. In any event, a jeopardy opinion is not legally or factually warranted for any of the Upper Snake BOR projects.

PROPOSED ACTION

It is useful to summarize the historical circumstances leading to the proposed action with respect to the Upper Snake BOR projects in order to provide perspective on the jeopardy opinion and RPAs included in the Draft BiOp.

Flow augmentation from the Upper Snake River was originally requested as an "experiment" or an "interim" measure. The Northwest Power Planning Council ("NPPC") suggested flow augmentation as an "experiment" to test the hypothesis that there is a "relationship between spring and summer flow, velocity and fish survival" in an adaptive management framework (NPPC, 1994, p. 5-13). In support of the 1995 BiOp on the FCRPS, NMFS called for "interim target flows" — and thus, flow augmentation —

on the basis of the NPPC program and a finding that "… a general relationship of increasing survival of Columbia River basin salmon and steelhead with increasing flow is reasonable" (NMFS, 1995, pp. 1, 2). In essence, in the 1995 and 1998 BiOps, the 427 kaf of Upper Snake flow augmentation was included as part of an interim, experimental mitigation package for the jeopardy caused by FCRPS operations or its take of listed species. Despite the lack of scientific evidence or legal basis for flow augmentation, Idaho water users acquiesced in the experimental program and helped pass state legislation to authorize the use of water for flow augmentation. Several years of research were conducted to assess the effects of flow on the survival of listed species. As discussed below and in Attachment 1, no significant benefit from Upper Snake River flow augmentation is evident from the research. Thus, the basis for the NMFS interim flow augmentation no longer exists.

More recently, the 1999 BiOp on the Upper Snake BOR projects, finalized on December 9, 1999 (about seven months before the Draft BiOp), did not find jeopardy from operation of these projects. The 427 kaf augmentation was included in that BiOp as a continuation of an interim measure required by the 1995 and 1998 BiOps on the FRCPS. In the current consultation, the agencies once again propose to continue the actions undertaken as a result of the 1995, 1998, and 1999 BiOps, i.e., to continue to provide 427 kaf of flow augmentation from the Upper Snake.[5]

In the Draft BiOp RPAs, NMFS includes additional measures to firm the 427 kaf of flow augmentation and seeks additional water to provide even more flow. That decision was made despite the fact that flow augmentation has previously been recognized by NMFS only as an interim measure, and not a permanent means for recovering salmon: "the species' biological requirements in the migratory corridor are likely to be met over the long term only if there are major structural modifications to the FCRPS that result in significant survival improvements" (1999 BiOp, p. II-3). As an interim and experimental measure, Idaho water users have continued to expect that flow augmentation using water from the Upper Snake River basin would be eliminated as part

[5] The proposed actions involving the Upper Snake BOR projects also include using powerhead space in the reservoirs to firm the water supply, a proposal that the Idaho water users consider to be illegal and thus invalid.

of the long-term decision encompassed in this Draft BiOp, particularly in light of the lack of any scientific support for flow augmentation from Idaho.

HISTORICAL AND HYDROLOGICAL BACKGROUND

In order to provide context for the rest of our comments, some background is useful. The history of irrigation development and the BOR projects in southern Idaho, listed species declines, and hydrology of the Upper Snake River basin are provided below.

History of Upper Snake BOR Projects

The Reclamation Service began studies in most western states and territories for possible projects shortly after the Reclamation Act was passed in June 1902. In Idaho, those surveys led to two early irrigation ventures involving the Snake River watershed. These undertakings are the Minidoka Project, which was initially authorized in 1904; and the Boise Project, which was initially authorized in 1905. Although several other BOR projects exist in the Upper Snake basin (Michaud Flats, Little Wood River, Mann Creek, and Owyhee), the Minidoka and Boise Projects are the largest.

Minidoka Project lands extend discontinuously from the town of Ashton in eastern Idaho along the Snake River approximately 300 miles downstream to the town of Bliss in south-central Idaho. The project includes: Minidoka Dam (also known as Lake Walcott) on the Snake River near Rupert, Idaho (completed in 1906); Jackson Lake Dam on the Snake River near Wilson, Wyoming (completed in 1911); American Falls Dam on the Snake River near American Falls, Idaho (completed in 1927); Island Park Dam on Henry's Fork, a tributary of the Snake, near Saint Anthony, Idaho (completed in 1938); Grassy Lake Dam on Grassy Creek in Wyoming (completed in 1939); and Palisades Dam on the South Fork of the Snake River (completed in 1957).

Known as the Payette-Boise Project prior to 1911, the Boise Project was built in two parts—the first being the Arrowrock Division, and the second being the Payette Division. The Arrowrock Division, which serves lands situated between the Boise and Snake Rivers, was authorized on March 27, 1905 and includes: the Boise River Diversion Dam on the Boise River near the City of Boise (completed in 1908); Lake Lowell (also known as Deer Flat Reservoir) storing Boise River water offstream near Nampa, Idaho (three dams completed between 1908 and 1911); Arrowrock Dam on the Boise River near the

City of Boise (completed in 1915); and Anderson Ranch Dam on the South Fork of the Boise River (completed in 1947).

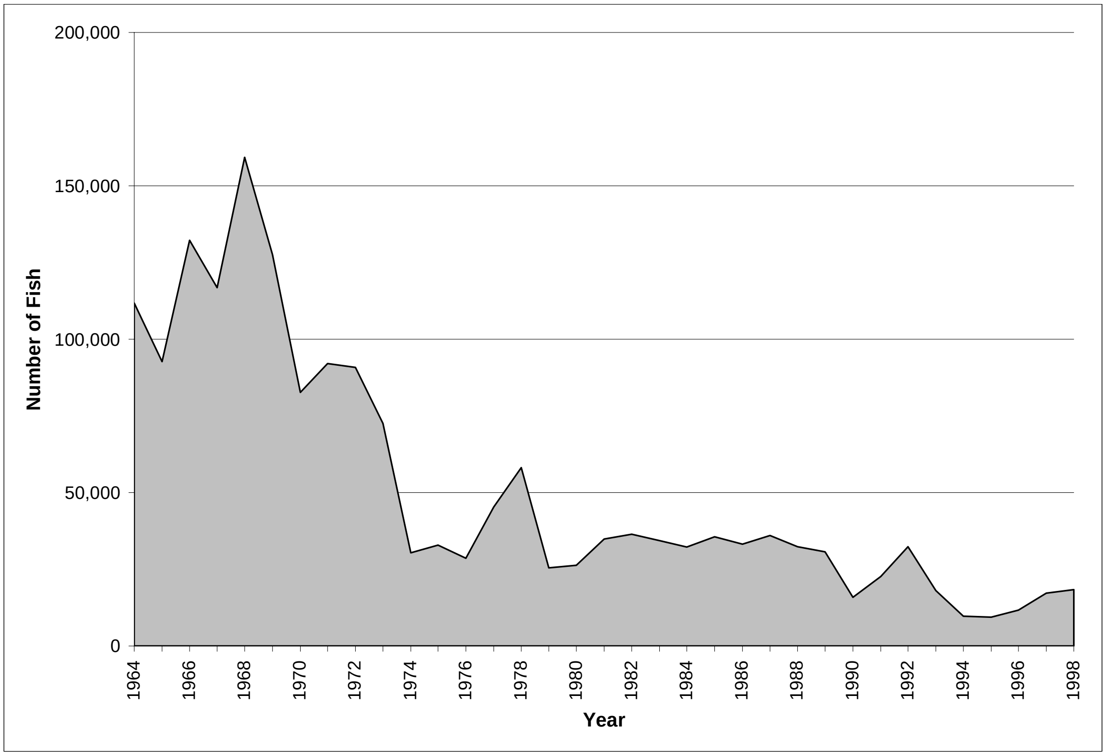
The Payette Division of the Boise Project consists of Deadwood Dam, Black Canyon Dam, and Cascade Dam. The Payette Division serves lands between the Payette and Boise Rivers and areas north of the Payette River in the Emmett Irrigation District. Authorized on October 19, 1928, the Division includes: Black Canyon Dam on the Payette River near the town of Emmett (completed in 1924), Deadwood Dam on the Deadwood River, a tributary of the South Fork of the Payette River (completed in 1931); and Cascade Dam on the North Fork of the Payette River near the City of Cascade (completed in 1948).

In section 6.2.5, the Draft BiOp appears to greatly overstate the impact of Upper Snake BOR projects by attributing 3.8 MAF of depletion to those projects (p. 6-29) because these projects are only part of the development of water resources that has become the backbone of Idaho's economy. Beginning in 1836 on land inhabited by the Nez Perce Indians, irrigation expanded to encompass about 1.5 million acres in 1909, largely from private irrigation developments that relied on the natural flow of streams (Arrington, 1986; 1910 Census). Another 500,000 acres was developed largely as a result of storage facilities constructed by the United States in the first half of the 20th century. About 1 million acres is the result of irrigation by wells, most of which have been drilled since the 1950s (IWRB, 1996). Surface and ground water sources in the Snake River basin in Idaho now irrigate over 3 million acres (IWRB, 1996).

History of Listed Species Decline

As described in the Draft BiOp, the listed species have gone through two general periods of population decline (pp. 4-1 *et seq*). The first period of decline was the late 1800s and early 1900s, primarily as a result of high harvest levels (p. 5-8). The second period of decline generally occurred after the 1960s as the result of a number of factors including additional major dams on the Columbia and lower Snake Rivers, and continuing changes in habitat, hatchery effects, and ocean conditions (pp. 5-3 *et seq)*. As shown in Figure 1, this second decline resulted in the low population levels, which resulted in the listings under the ESA. It is important to note that the listed salmonid populations were self-sustaining long after water development of the Upper Snake was complete.

Figure 1. Returns of wild salmon and steelhead to the uppermost dam on the Snake River below Hells Canyon (Ice Harbor 1964-68; Lower Monumental Dam 1969; Little Goose Dam 1970-74; Lower Granite Dam 1975-99).



Hydrology of the Upper Snake River

Total annual outflow from Idaho into the Columbia River system is about 70 million acre feet (MAF), or roughly one-third of the total flow of the Columbia River (IWRB, 1996). About one-half of this flow is provided by northern Idaho tributaries and one-half is from the Snake River. Average annual flow of the Snake River as it leaves the state at Lewiston is about 36 MAF (Id.). Roughly one-third of this amount comes from the Upper Snake River above Hells Canyon and about one-half is contributed by the Salmon and Clearwater River basins (Id.). The remainder is contributed from smaller tributaries in Oregon, Washington, and Idaho.

Stream flow records do not extend back to the beginning of irrigation in the mid-1800s. However, records for stream flow in the Upper Snake River basin do exist from about 1910 on. As noted in the previous section, the construction of reservoirs and development of irrigation on about 1.5 million acres has occurred since 1910. However, the historical record reflects a slight increase in flow despite development in southern Idaho. Again, it must be recalled that the Upper Snake BOR projects are only part of the irrigation development in Idaho.

Figure 2 shows the actual mean annual flow for the Snake River at the Weiser gage, located just above Brownlee Reservoir, for the period 1911 through 1999. As can be seen from the trend line plotted on the graph, average annual flows have <u>increased</u> slightly over the past 89 years despite water development in the Upper Snake River basin. Figure 3 shows the actual mean summer flow for July 1 through August 31 for the period 1911 through 1999 without flow augmentation. This period was selected to match the time during which flow often falls short of NMFS' targets and the season for which there has been concern over juvenile fall chinook migration. Again, the trend line plotted on the graph shows that the measured flows of the Snake River at Weiser have <u>increased</u> over the past 89 years during the summer period. As discussed in the next section, analysis of the minimum flow for the flow target periods 4/3 through 6/20 and 6/21 through 8/31 show the same pattern of slightly increasing minimum flows for the period from 1911 through 1999.

The tremendous variation in flows can also be seen in Figures 2 and 3. At Weiser, mean annual flows vary by over 350 percent and summer flows vary by over 300 percent. These fluctuations are primarily the result of natural variations in climate. The 427 kaf of Upper Snake flow augmentation (about 3.5 percent of the average annual flow) is dwarfed by this huge natural flow variation at Weiser. Upper Snake flow augmentation can do little to offset the variability of natural flows below Hells Canyon.

Similarly, the historical hydrology at Lower Granite Dam does not reflect decreasing flows. Figures 4 and 5 show the same trend of increasing mean annual and summer (July 1 through August 31) flows at Lower Granite for the period 1911 through 1999 as shown for the Snake River at Weiser.[6]

[6] Flow augmentation provided in recent years has been subtracted from gage data before plotting the mean flows on Figures 3 and 5.

The fact that the quantity and timing of Snake River flow has not changed significantly is not new. In 1995, the National Research Council concluded:

> "*Because there has not been a major shift in the Snake River hydrograph, it is doubtful a priori that the declines in Snake River salmon stocks are due to or reversible by changes in the seasonality of the flow regime of the Snake River alone*" (NRC, 1995 at 193).

Despite these facts, which have been repeatedly pointed out to NMFS,[7] the Draft BiOp asserts that the Upper Snake BOR depletions "are a major impediment to meeting NMFS' flow objectives" (p. 6-28). Failure to take these facts into account or respond to them is arbitrary and capricious on the part of NMFS.

[7] See Idaho water users comments on the draft White Paper and draft All-H paper.

Figure 2

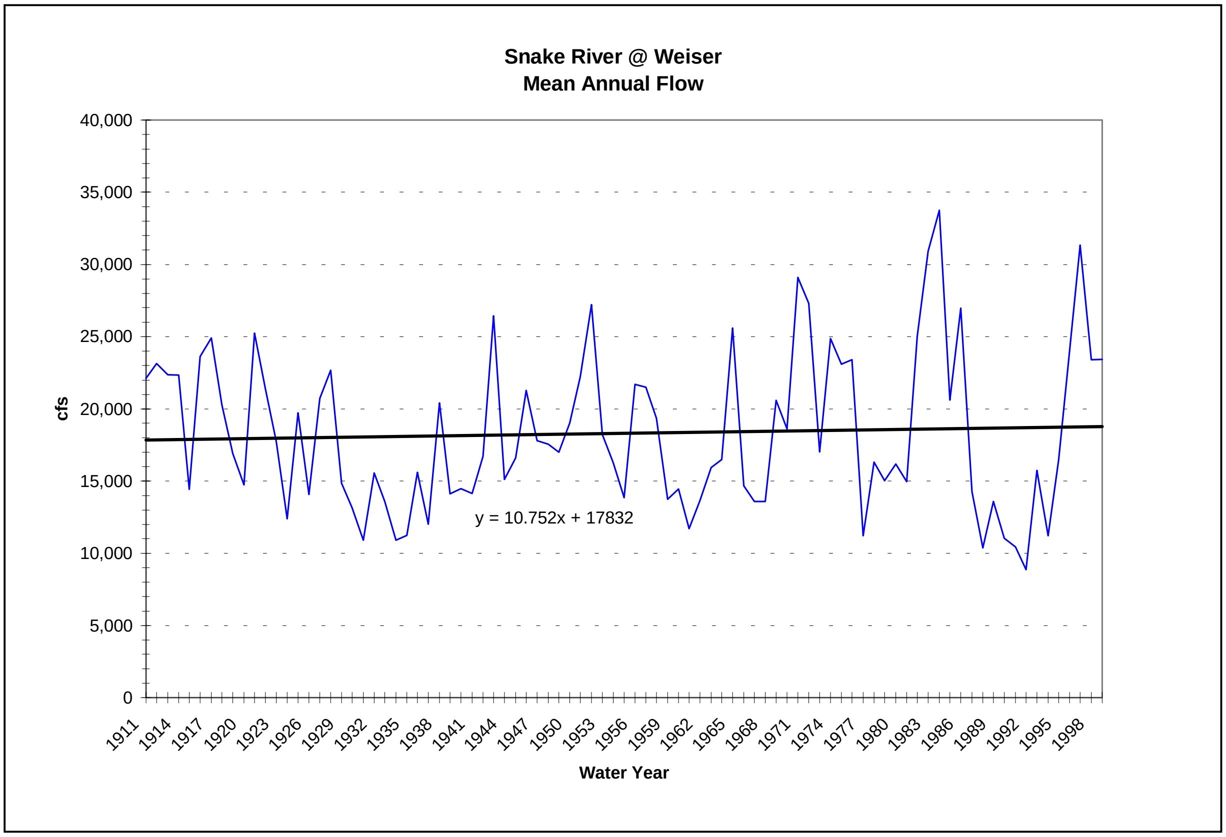


Figure 3

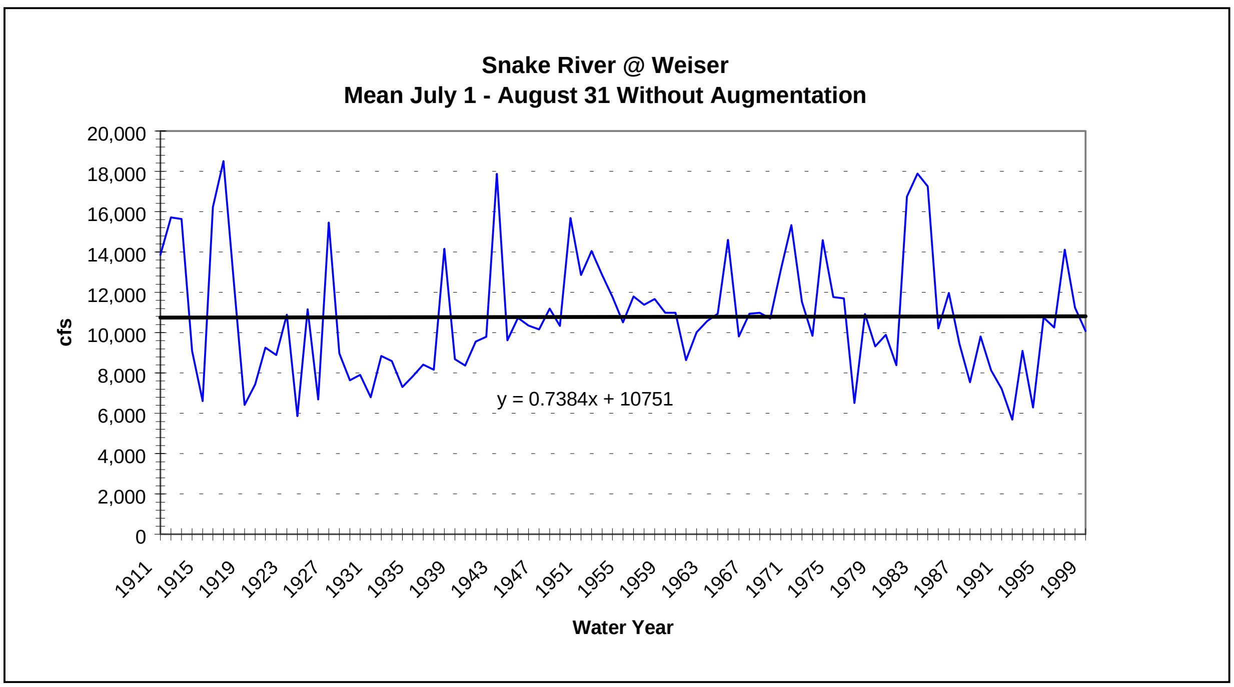


Figure 4

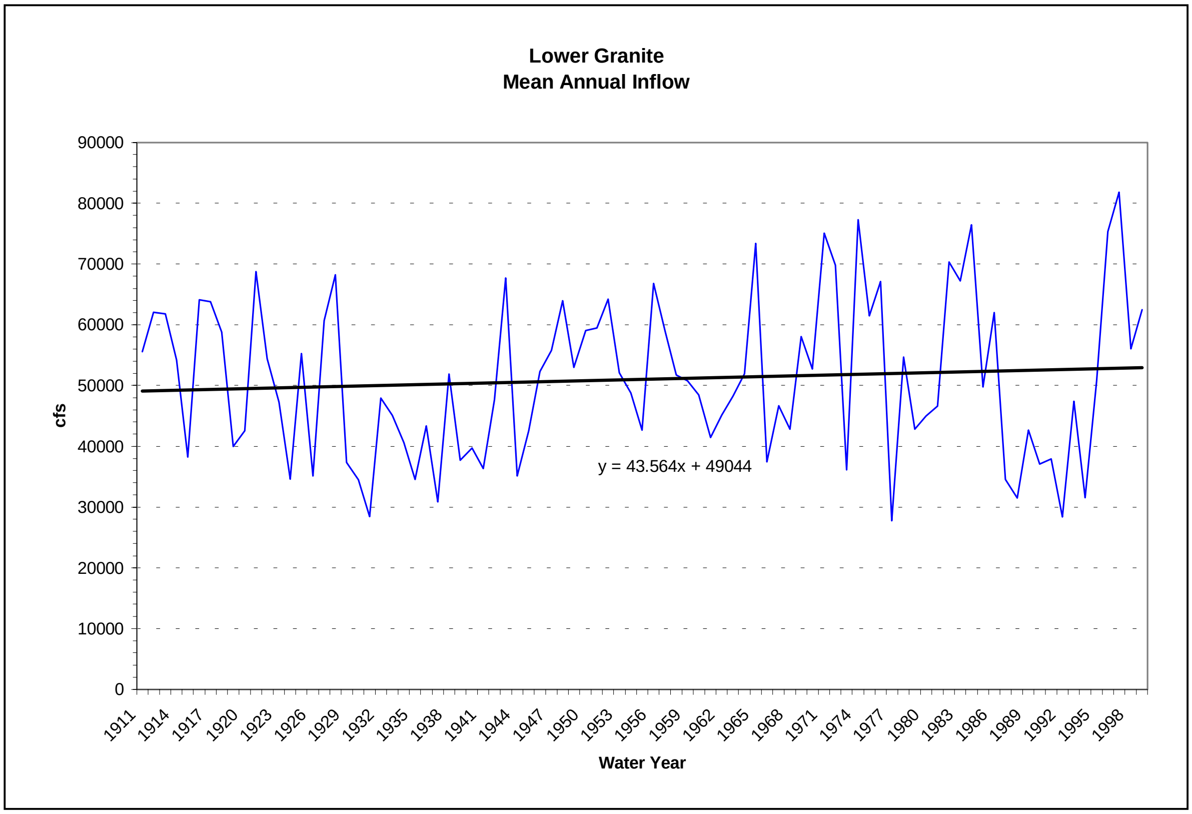
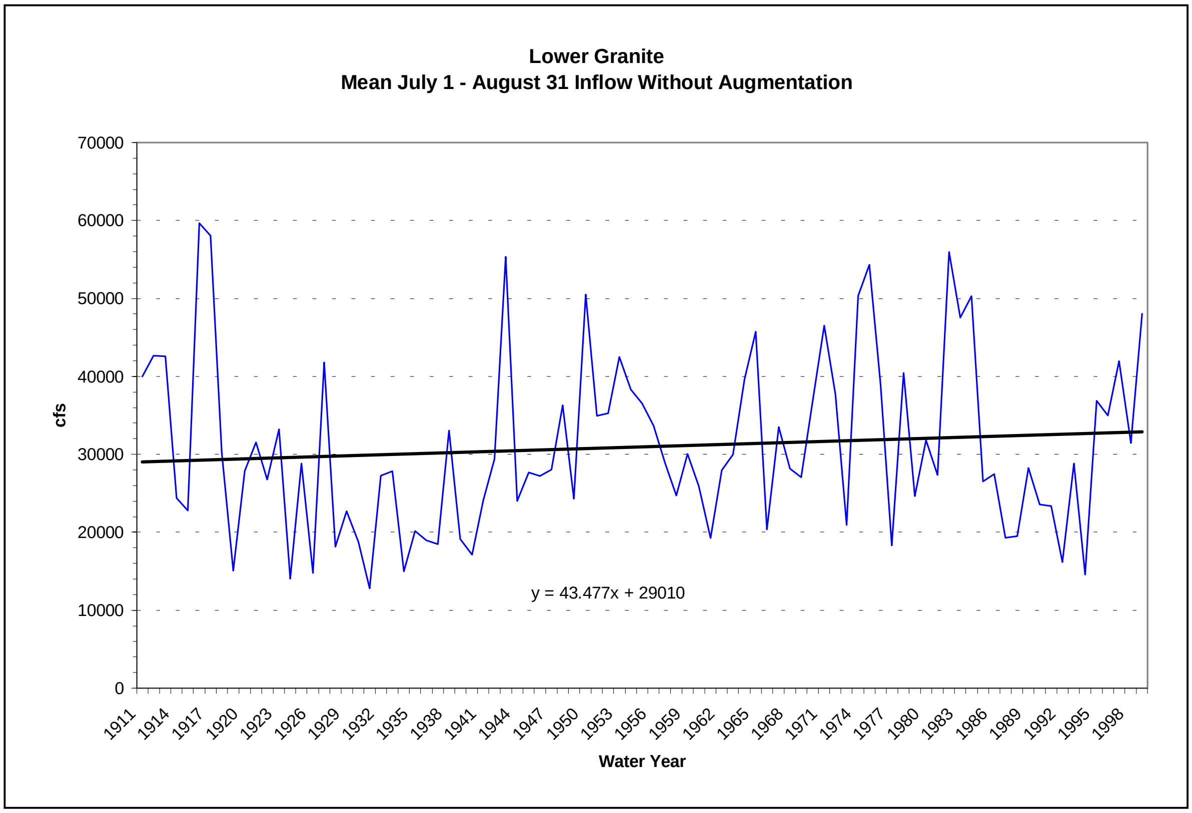


Figure 5



FLOW ALTERATION FROM THE UPPER SNAKE RIVER BOR PROJECTS HAS NOT CAUSED JEOPARDY

In Section 6.2.5.2.3 of the Draft BiOp, NMFS asserts that "[o]peration and configuration of BOR's irrigation projects could affect salmon survival …[indirectly through] changes in flow timing due to reservoir storage management activities, and streamflow depletion from water withdrawals" (p. 6-27, emphasis supplied). In fact, as discussed in the previous section, the Upper Snake BOR irrigation projects operated for decades prior to the precipitous decline of listed species populations in the 1970s and 1980s, which led to their listing and thus, the projects had no role in the subsequent decline of the listed species. Even with operation of these projects, the average flow of the Snake River at Lower Granite has remained relatively constant through the years and the flow has actually increased during the critical summer months because of irrigation return flows from the BOR operations and other upstream irrigation. Moreover, much of the water diverted from the streams by water users in southern Idaho is done pursuant to state water rights for natural flow. These diversions are not subject to BOR operation and control. Finally, as discussed in the next major section of these comments involving the biological effect of the Upper Snake BOR projects, the relatively minimal flow alteration from these projects has no significant effect on salmonid migration and survival.

As illustrated in Figure 2, the mean annual flow of the Snake River at Weiser has not changed significantly since flow records became available in 1911. Likewise, the variation of flow between years has not changed significantly. Figure 2 is constructed of measured data and is not based on theoretical calculations or assumptions. This time-series analysis is not provided to suggest that Upper Snake irrigation development and BOR storage projects do not consume water or have not affected downstream flow. Rather, these flow records demonstrate that there is no factual support for the premise that flow alterations from the Upper Snake have jeopardized or will jeopardize the listed species.

Figure 6 contains the same mean annual flow data used to prepare Figure 2 and, in addition, shows the development of irrigated acreage in Idaho and the development of

Upper Snake BOR water storage.[8] Figure 6 shows that irrigated acreage significantly increased and most of the BOR storage development occurred after flow measurement records for the Snake River at Weiser began. Figure 6 also shows both irrigated acreage and BOR storage increasing throughout the period but without a significant change in the mean annual flow of the Snake River at Weiser.

By the early 1920s, about 2.5 million acres were irrigated in Idaho, yet the BOR had only about 1.5 MAF of storage capacity in the Upper Snake River basin. Many of the irrigated acres were developed with private water rights and without benefit of BOR stored water. The lack of storage for full water supplies is shown, in part, by the decrease in the number of irrigated acres during the drought years of the late 1920s and the early 1930s. As BOR storage became available, many irrigators relied upon the stored water to supplement their private water rights in order to have a full water supply.

Table 6.2-1 and Table 6.2-2 In the Draft BiOp show relatively large <u>estimates</u> of the amounts of water consumed by Upper Snake BOR projects and reductions of flow at Lower Granite Dam (pp. 6-29, 6-30). Regardless of those estimated depletions, Figure 6 shows conclusively that both the number of irrigated acres and the amount of BOR storage have increased during the period of record for the Snake River gage at Weiser, which shows a slight increase in the mean annual flow.

This analysis of historical acreage in comparison to flows is similar to the analysis by Dreher and the results are consistent with those found by Dreher (Dreher, 1998, pp. 5-7). Dreher's analysis has been criticized by DeHart (1998) on several bases. The comparison of the development of irrigated acreage and BOR storage over time counters the criticism

[8] The BOR storage represents all reservoirs above Brownlee. The irrigated acreage is taken from Census Reports and include all irrigated acres in Idaho (United States Census Office, 1902-1997). The Census Reports do not separate the number of irrigated acres by river basin within a state. The irrigated acreage reported for Idaho includes acreage outside of the Snake River basin upstream from Weiser including the Bear and Salmon River drainages. Similarly, the reported irrigated acreage does not include acres irrigated from the Snake River basin above Weiser located in Wyoming, Nevada, and Oregon. The differences in the chart from actual acreage irrigated from the Snake River basin upstream from Weiser is believed to be minimal since most of the irrigated acreage in Idaho is irrigated from the Snake River basin upstream from Weiser and most of the acreage irrigated from the Snake River basin above Weiser is in Idaho.

that the major impacts of Idaho irrigation development were in place prior to the period of analysis. In fact, much of the development, particularly the Upper Snake BOR projects, has taken place during the period of record. DeHart also suggests that the recent low flows are lower than the historical low flows, and that this change in low flows is masked by an analysis that relies solely on mean annual flow amounts. Figure 7 contains two curves, one for the minimum mean daily flow of the Snake River at Weiser for April 3 through June 20, and one for the minimum mean daily flow of the Snake River at Weiser for June 21 through August 31.[9] The two curves represent the minimum flow for each year during the respective periods. Trend lines are added to the curves and show the minimum mean daily flow for both periods has increased, on average, over the period of record.

The depletion analysis in Tables 6.2.1 and 6.2.2 is in error because it ignores how the Upper Snake BOR projects actually operate. Water is stored in the project reservoirs during the winter and spring (except during major flood control operations when low flows are not an issue) and then released for irrigation purposes during the summer, primarily to supplement natural flow water rights. Thus, any reduction of flow actually occurs during seasons when the flow targets at Lower Granite are typically met (spring) or do not exist (winter). The Draft BiOp's assumption that crop water consumption estimates in a particular month are directly related to the downstream flow depletion for that month is not accurate given the time lag between storage and release of the water.

NMFS apparently relies upon the erroneous <u>estimates</u> in Table 6.2-1 and Table 6.2-2 to conclude the Upper Snake BOR projects cause jeopardy for the listed species, yet the <u>measured</u> flow of the Snake River at Weiser shows that no change has occurred following much of the irrigation development and nearly all of the BOR storage construction in the Upper Snake River basin. Although the listed species were in decline due to over harvest by the early 1900s, there is no evidence to suggest that the populations were limited by

[9] Augmentation flow was removed from the records for the recent years before the minimum values were selected and plotted.

either habitat or passage conditions caused by flow alteration from the Upper Snake. Habitat and passage conditions resulting from Upper Snake flows were the same in the first half of the 20th century as they are today.

Of course, the listed species no longer reach the Snake River at Weiser because they have been excluded from the Upper Snake River basin since the 1950s due to construction of the Hells Canyon complex. Thus, there is no direct effect on the listed species due to irrigation in southern Idaho or operation of the Upper Snake BOR projects. Because the flow conditions of the Snake River at Weiser have not materially changed, and because the population of the listed species has not been limited by habitat or passage constraints imposed by irrigation or BOR storage in the Upper Snake River basin, there is no basis to find jeopardy due to indirect effects. In other words, changes in Idaho water use did not cause and cannot cure the decline of listed fish populations.

Figure 6. Snake River @ Weiser Mean Annual Flow, Irrigated Acres and Reclamation Storage.

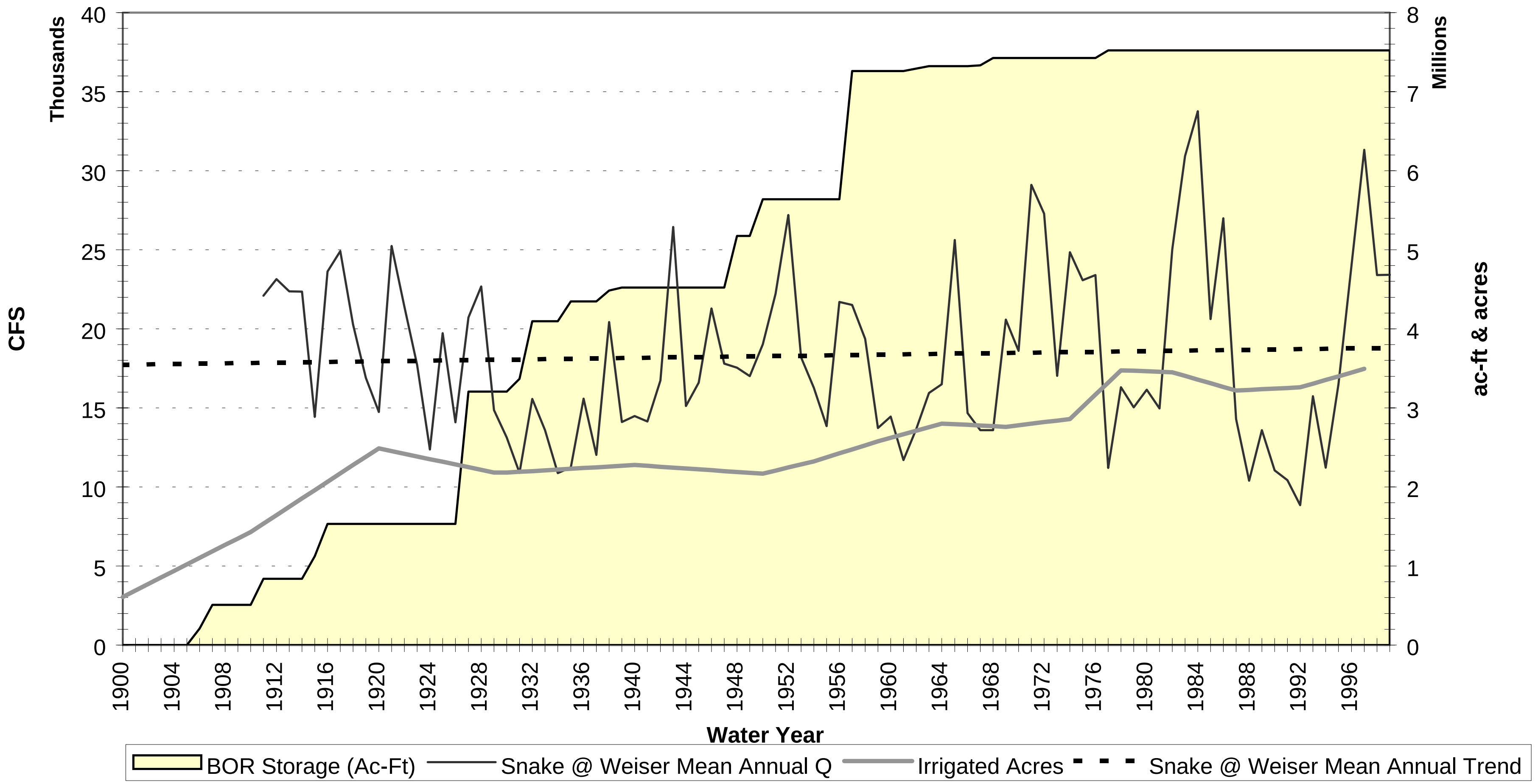
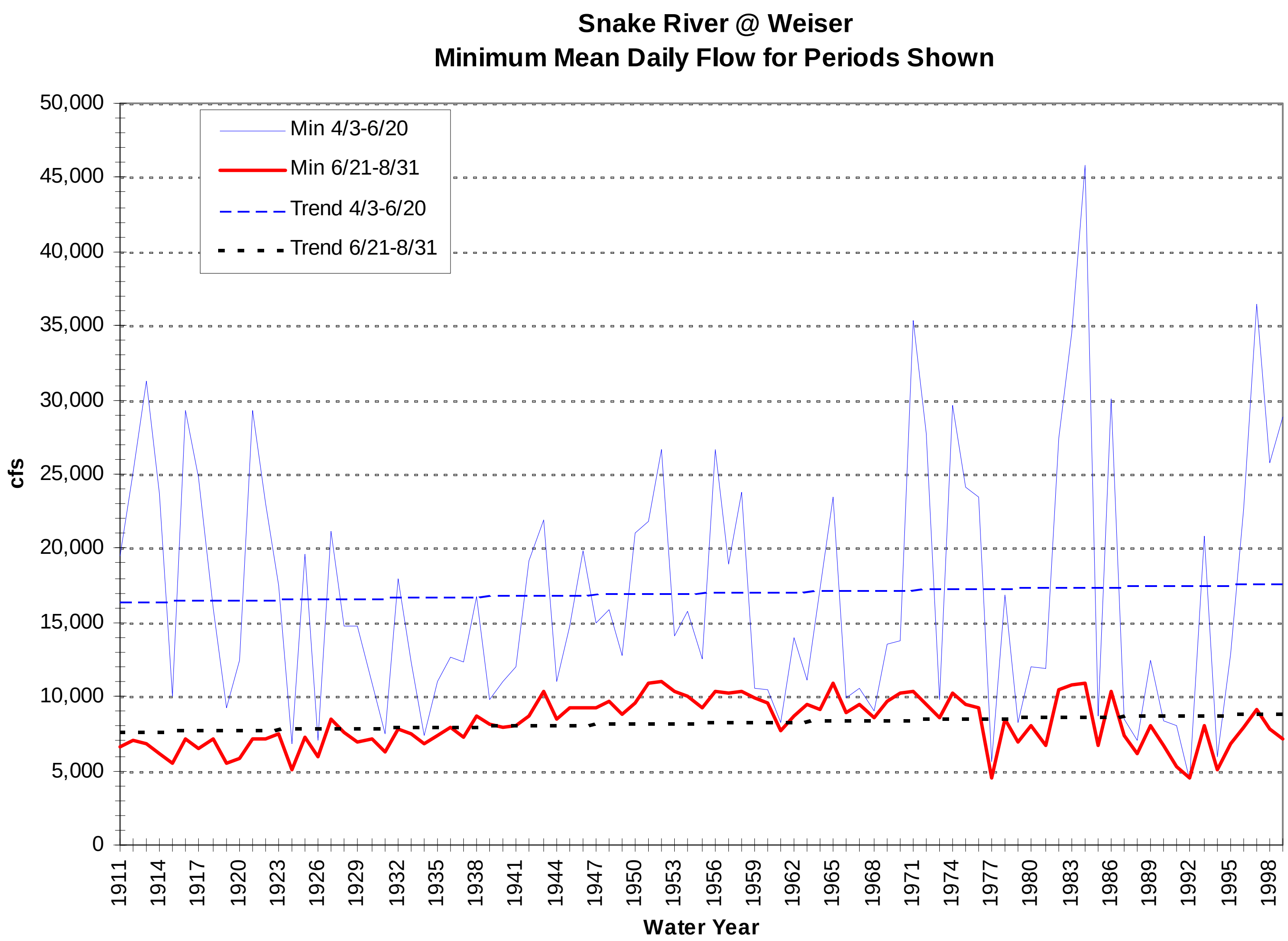


Figure 7.


Snake River @ Weiser
Minimum Mean Daily Flow for Periods Shown
Min 4/3-6/20
Min 6/21-8/31
Trend 4/3-6/20
Trend 6/21-8/31
cfs
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
1911
1914
1917
1920
1923
1926
1929
1932
1935
1938
1941
1944
1947
1950
1953
1956
1959
1962
1965
1968
1971
1974
1977
1980
1983
1986
1989
1992
1995
1998
Water Year

THE FLOW-SURVIVAL HYPOTHESIS USED IN THE DRAFT BIOP IS UNFOUNDED

Even if the Upper Snake BOR projects altered the downstream flow, the biological effect of those changes is insignificant to the listed species and their habitat. The Draft BiOp hypothesizes a variety of mechanisms by which historical flow alterations have negatively impacted listed fish and their habitat and by which future flow augmentation can provide benefits. These mechanisms include changes in velocity, turbidity, temperature, and conditions in the estuary or ocean plume (pp. 6-23 to 6-41). There is no reliable evidence that changes in Upper Snake River water use have had or will have a significant effect on these variables or on the bottom line—survival of the listed species.

The Draft BiOp analysis and conclusions related to the flow/survival relationship for listed species rely extensively on the March 2000 White Paper entitled "Salmonid travel time and survival related to flow management in the Columbia River Basin" ("White Paper"; NMFS, 2000a) (pp. 2-3, 2-10, 6-34). Further evaluation of the assertions in the White Paper, and replies to NMFS responses to comments on the draft White Paper are contained in Attachment 1.

Flow and Velocity

The Draft BiOp suggests that downstream migration of juvenile salmon could be improved by using flow augmentation to increase the rate of flow through the reservoirs along the lower Snake and Columbia Rivers to speed up migration (pp. 6-34 to 6-36). However, there are no quantitative analyses of the velocity changes achievable with flow augmentation, objectives for velocity changes, or analyses of the biological benefits of incremental changes in velocity.

The Draft BiOp begins to recognize that Upper Snake flow augmentation is futile to mitigate the velocity reductions resulting from dams on the lower Snake River (p. 6-36). For example, adding 1 MAF annually to existing flows results in less than $^{1}/_{10}{}^{th}$ of 1 mile per hour increase in velocity through the lower Snake River reservoirs (Dreher, 1998, p. 12). Stated another way, more than 160 MAF (over 4 times the existing flow) would be required to restore pre-dam velocities that exceeded 2.5 mph (Id.). Clearly, any possible level of flow augmentation from the Upper Snake River would have an insignificant effect on water velocity through the lower Snake River (Id.).

Flow and Turbidity

The Draft BiOp also suggests that downstream migration of juvenile salmon could be improved by increasing the downstream turbidity using flow augmentation (p. 6-36). Again, there are no quantitative analyses of the turbidity changes achievable with flow augmentation, objectives for turbidity changes, or analyses of the biological benefits of incremental changes in turbidity. Moreover, there is no reconciliation of the calls for increased turbidity in the Draft BiOp with the reductions in sediment load required by the Clean Water Act.

Significant increases in turbidity are not likely as a result of Upper Snake flow augmentation. Most instances of increased turbidity in the lower Snake River are the result of high tributary inflows due to storm events or snowmelt.

Flow and Temperature

Flow augmentation is also suggested as a means to improve water temperature in the lower Snake River (p. 6-36). Cold water has been released from Dworshak Reservoir in the Clearwater Basin to lower temperatures in the river for the benefit of salmon (NMFS, 1999, pp. 29, 30). However, warm water released from the Upper Snake River counteracts the cooling effect of releases from Dworshak Reservoir, especially during low flow years when temperatures are generally the highest (Corps, 1995, p. 4-61). Once more, the Draft BiOp contains no quantitative analyses of the temperature changes achievable with flow augmentation, objectives for temperature changes, or analyses of the biological benefits of incremental changes in temperature.

To illustrate the problem of augmenting with warm Snake River water, the effect of the existing flow augmentation on the temperature downstream of Brownlee can be estimated.[10] First, it can be demonstrated that the temperature (Θ) in the Snake River below Hells Canyon (at River Mile 180)[11] is essentially determined by the sum of the flow-weighted (*F*) temperatures of the Snake, Imnaha and Salmon rivers according to the formula:

$$\Theta_{Rm180} = \frac{\Theta_{Salmon} F_{Salmon} + \Theta_{Imnaha} F_{Imnaha} + \Theta_{Snake} F_{Snake}}{F_{Salmon} + F_{Imnaha} + F_{Snake}}$$

Figure 8 shows the regression of predicted and observed temperatures at RM 180. The equation predicts the observed temperatures quite well ($R^2 = 0.9989$, slope = 1.0, intercept = (–) 0.17). Figure 9 shows that flow and temperature are not correlated just downstream of Hells Canyon Dam at RM 246. Figure 10 shows that river temperature at Anatone and air temperature at Lewiston are linearly related. These three relationships demonstrate that Upper Snake flow augmentation does not significantly affect the temperature of the Snake River entering Lower Granite Reservoir.

[10] Additional information on the flow/temperature relationships described in the following paragraphs will be provided in a paper authored by James J. Anderson and posted on the Columbia River Basin Research website (http://www.cqs.washington.edu/library.html) as soon as it is final.

[11] River Mile 180 (RM 180) is below the confluence of Snake, Imnaha and Salmon rivers, about 75 miles upstream from Lower Granite Dam (RM 106).

Figure 8. Observed temperature and predicted temperature at RM 180.

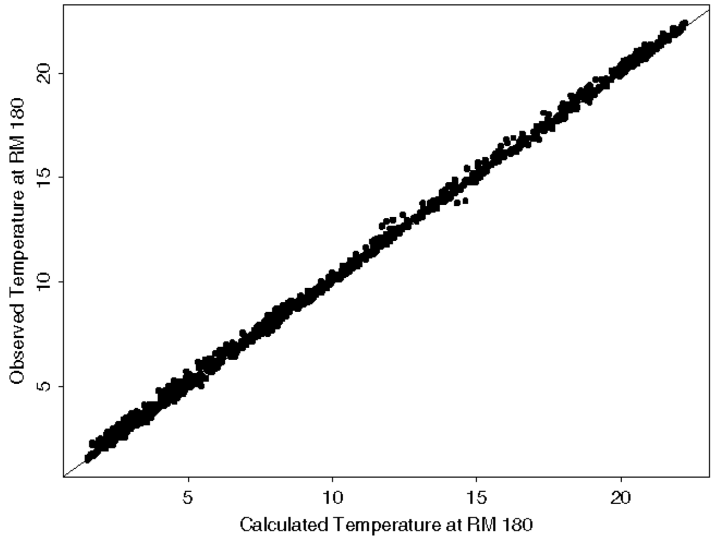


Figure 9. Flow is unrelated to temperature immediately below Hells Canyon dam. Data covers years 1991-1997.

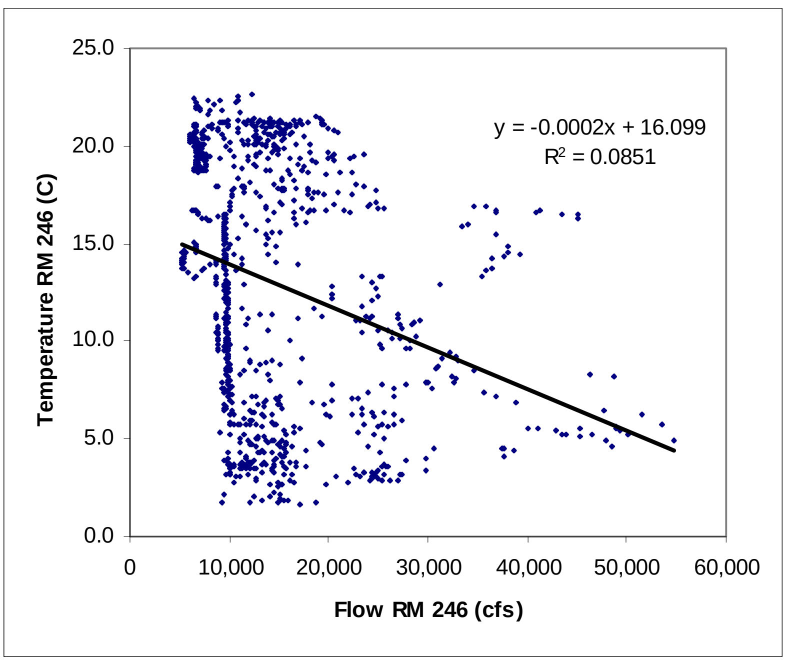
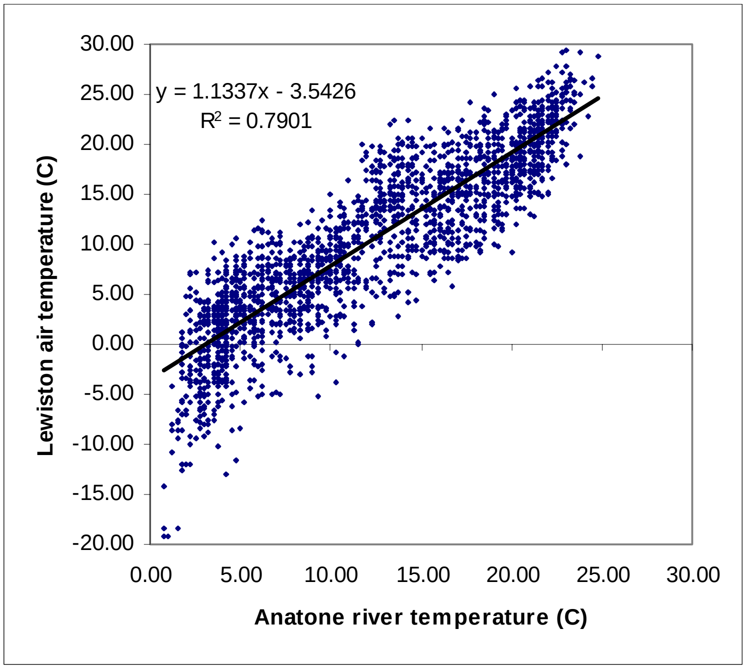


Figure 10. Air and water temperature are correlated. Data from years 1991 to 1997.



The effects of Upper Snake flow augmentation on downstream temperature at RM 180 can be calculated by changing Snake River flows (F_{Snake}) to reflect different levels of flow augmentation. Figure 11 illustrates the difference in river temperatures at RM 180 with the additional 427 kaf. Note that Snake River flow augmentation has a small effect on the river temperature and that the augmentation typically causes river temperature to increase relative to the predicted temperature without augmentation. This graphically illustrates the problem with the assumption that flow augmentation is uniformly good for fish. In fact, the model indicates that Snake River temperatures would be reduced if Snake River flows were held constant. This is illustrated in Figure 12, which shows the predicted difference in river temperature caused by existing flow augmentation relative to temperatures with a constant Hells Canyon flow of 5000 cfs.

Figure 11. Temperature change resulting from the existing flow augmentation.

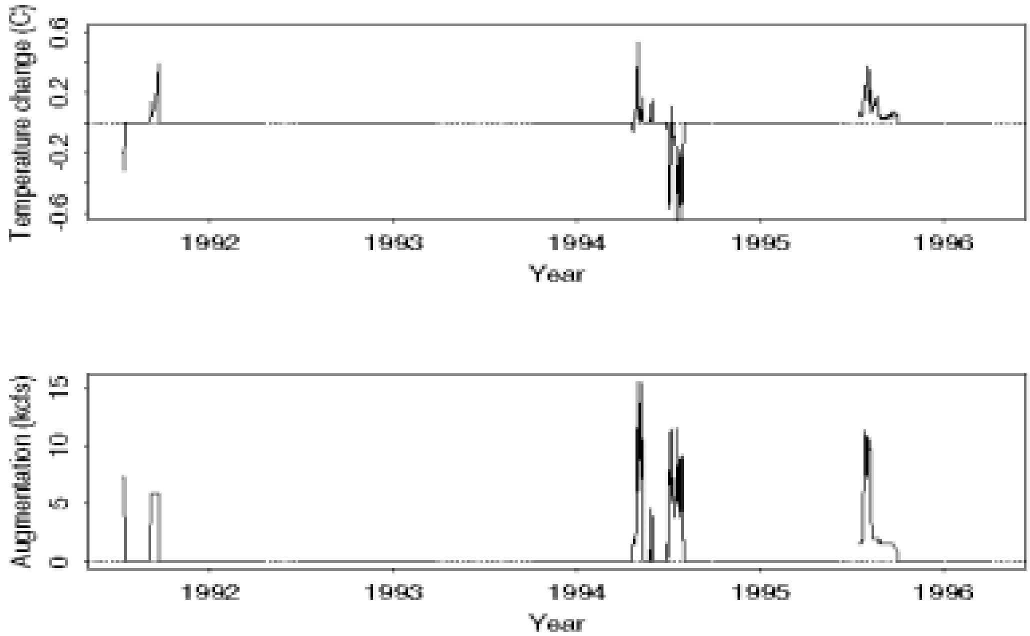
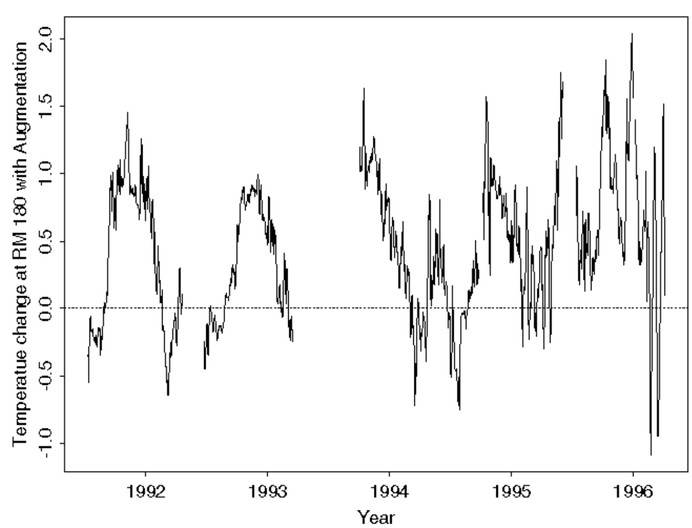


Figure 12. Temperature increase with the existing flow augmentation relative to temperature if Hells Canyon flows were limited to 5000 cfs.



A study of the limnology of Brownlee reservoir supports the detrimental effect of summer flow augmentation from the Upper Snake under some conditions (Ebel and Koski, 1968). The study found that the reservoir stratifies in the summer with the epilimnion (warm upper layer) extending down to or below the outlet works in July, August and September during the period of study (Id., Fig. 2). The study also evaluated the effect of the reservoir on Snake River flows above and below the Hells Canyon dams. Relative to Snake River inflows to Brownlee, temperature was higher and dissolved oxygen levels were lower below Oxbow from mid-summer through fall (Id., Fig. 20). Thus, Upper Snake flow augmentation during times such as these would exacerbate the impact of water releases that are of poorer quality than inflows and which can be detrimental to fish.

Estuary/Plume Effects

Flow augmentation also is being hypothesized as a way to change the timing of the arrival of smolts at the estuary to pre-dam conditions (p. 6-34). The suggested use of flow is perplexing for two reasons. First, about 80 to 90 percent of Snake River chinook and steelhead passing through the estuary arrive through transportation. Transportation shortens the hydrosystem passage by two weeks for spring chinook and a month or more for fall chinook, resulting in estuary arrival times similar to the pre-dam conditions. Under the existing hydrosystem operation, only 10 to 20 percent of migrating fish travel in-river. At most, flow augmentation may only change the arrival time of the remaining 10 to 20 percent of in-river migrating fish by a few hours for spring chinook and a few days for fall chinook, although we do not concede that such reductions will occur (see discussion below). Unless it can be demonstrated that these small changes in arrival timing will occur and will benefit the survival of listed fish, attempting to use flow augmentation to speed arrival timing at the estuary for a small proportion of the fish is a gross misuse of water resources.

In a further attempt to find some basis for flow augmentation, the Draft BiOp suggests that higher flows might improve conditions in the estuary and provide survival benefits to juvenile salmonids migrating through the estuary or the Columbia River plume (p. 6-24, 6-34). As discussed above under *Hydrology of the Upper Snake River*, the volume and pattern of flow in the Snake River upstream from Lower Granite Reservoir has not changed significantly over the past 89 years. Thus, any changes that may have occurred in the Columbia River estuary or plume are not the result of upstream development on the Snake River. Further, the Upper Snake flows required to make significant changes in the estuary or plume are so large that any attempt to use Snake River augmentation water for that purpose is futile.

Table 1 compares minimum and maximum monthly discharges of the Columbia River at Beaver Army Terminal near Quincy, Oregon with the monthly discharge of the Snake River at Weiser during the same month. The Beaver Army Terminal gage is located at river mile 53.8 within the area of the river affected by tidal flow. Even though the gage record is short—12 years of records, some partial, from 1968 through 1999—it serves to show the wide variation in annual flow of the Columbia River. The <u>variation</u> in <u>monthly</u> flow from high to low years (18.5 MAF in June) is more than the entire average <u>annual</u> flow of the Snake River at Weiser (13.3 MAF).

Table 1 illustrates that the flow of the Columbia River at the beginning of the estuary is at least 10 times greater than the flow of the Snake River at Weiser under both high and low flow conditions. It is impossible to try to restore the lower Columbia to pre-development conditions using augmentation from a source that provides less than 10 percent of the flow during the spring and summer.

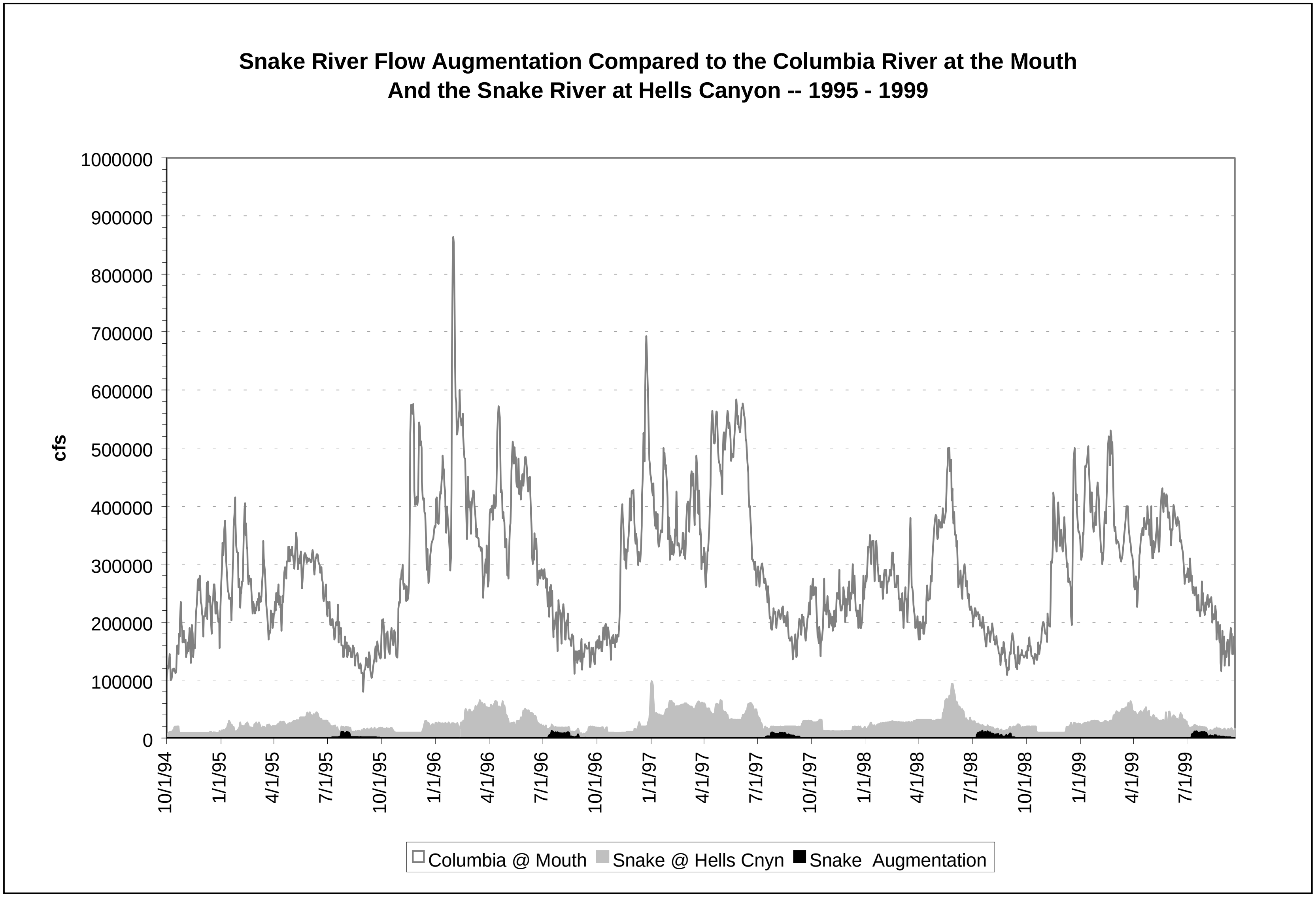
Table 1. Minimum and maximum monthly discharge of the Columbia River compared to Upper Snake River discharge in that month.

Month	Minimum Flow (MAF)			Maximum Flow (MAF)		
	Year	Lower Columbia River	Upper Snake River	Year	Lower Columbia River	Upper Snake River
April	1992	11.7	0.5	1969	24.2	2.3
May	1968	13.0	0.7	1997	31.2	2.5
June	1992	12.1	0.3	1997	30.6	2.9
July	1992	8.6	0.4	1997	17.2	1.1
August	1994	6.6	0.5	1999	13.7	0.8

Another way to consider the futility of using flow augmentation from the Upper Snake River to cause changes far downstream is to compare the period of record average flow of the Columbia River at Beaver Army Terminal for July, a relatively low flow month during the period of flow objectives, to recent levels of Upper Snake River flow augmentation. The average monthly flow of the Columbia River for July at this location is 14.1 MAF for the period of record at the Beaver Army Terminal gage. If the entire 427,000 acre-feet of Upper Snake River flow augmentation were released in July (contrary to past practice), it would be only 3 percent of the average monthly July flow of the Columbia River at Beaver Army Terminal. Figure 13 shows Upper Snake River flow augmentation from 1995-1999 in relation to the flow of the Columbia River at the mouth.

Simply put, augmenting flows to significantly change the estuary or plume would be fruitless and a waste of water resources. Moreover, this rationale for additional water is premature given the research plan in the RPAs to study whether there is any benefit from additional flows (pp. 9-133 *et seq*).

Figure 13.


Snake River Flow Augmentation Compared to the Columbia River at the Mouth
And the Snake River at Hells Canyon -- 1995 - 1999
cfs
1000000
900000
800000
700000
600000
500000
400000
300000
200000
100000
0
10/1/94
1/1/95
4/1/95
7/1/95
10/1/95
1/1/96
4/1/96
7/1/96
10/1/96
1/1/97
4/1/97
7/1/97
10/1/97
1/1/98
4/1/98
7/1/98
10/1/98
1/1/99
4/1/99
7/1/99
Columbia @ Mouth
Snake @ Hells Cnyn
Snake Augmentation

The Flow/Survival Relationship

There is no clear scientific basis for the mainstem flow targets and the requirements for flow management to meet those targets. Flow management involves augmentation or reshaping the volume of water flowing out of the Columbia/Snake River system over the season. Although there may be a weak flow/survival relationship <u>between years</u>, flows and survival have no relationship in the hydrosystem <u>within a season</u>. The relationship between fall chinook survival and flow above Lower Granite Dam cited in the Draft BiOp is statistically unfounded. Relationships noted in the BiOp relating flow or travel time to smolt-to-adult returns (SARs) are all compromised by the increasing number of dams over time, changing ocean conditions and changes in the hydrosystem.

The Draft BiOp gives a false impression that there is conclusive support for flow targets and misrepresents the NMFS flow analysis. For example, the Draft BiOp concludes that flow is strongly correlated with survival:

> "*To summarize, there are several studies which indicate a relationship exists between river conditions when juveniles out-migrated and the rate at which adults returned from those juvenile year classes. Years of higher river flow produced higher rates of adult returns than low water years*." (p. 6-35).
>
> "*Research conducted since 1995 suggest[s] that the spring flow objectives in the Action Agencies proposed action for the Snake and Columbia rivers are reasonable*." (p. 6-36).

Yet, the White Paper is considerably more cautious about any effects of flow on smolt travel time and survival:

> "C*orrelation does not necessarily imply causation (Sokal and Rohlf 1981), and higher SARs associated with higher flows does not necessarily indicate that SARs can be increased by adding more flow to the river*." (White Paper, p. 52)
>
> "*Thus, a relationship between adult returns and river flow might be the result of other factors correlated with river flow*." (Id.)
>
> "*In all cases where studies were updated to remove years before the hydropower system was completed and include more recent data, the newly obtained relationships were weaker than the previously published ones. In some cases, the newly analyzed data set did not contain the full range of water travel time or flows as in previous studies*." (Id.)

The last quote correctly notes that the hydrosystem has changed significantly with the addition of more dams over time. Moreover, the Draft BiOp and the White Paper fail to address the fact that the system has continued to change with improvements in smolt passage facilities and transportation. In addition, changes in ocean conditions greatly complicate the evaluation of hydrosystem survival.[12]

The Draft BiOp focuses on Upper Snake summer flow augmentation to directly benefit juvenile Snake River fall chinook and provide qualitative benefits to other runs as well (p. 6-36). However, NMFS acknowledges that: 1) "*relationships between flow and survival and between travel time and survival through impounded sections of the lower Snake River*" are neither strong nor consistent; and 2) a causal relationship between flow and smolt-to-adult returns (SAR) is not supported by recent data and analyses (White Paper, pp. 17, 22, 52). These issues are discussed further below.

As noted above, the Draft BiOp relies extensively on the White Paper on flow/survival, which we further address in Attachment 1.

Yearling Migrants (Spring/Summer Chinook and Steelhead)

In its White Paper, NMFS asserts:

> "*A strong and consistent relationship exists between flow and travel time. Increasing flow decreases travel time. Thus, although no relationship appears to exist within seasons between flow and yearling migrant survival through the impounded sections of the Snake River, by reducing travel times, higher flows <u>may</u> provide survival benefits in other portions of the salmonid life cycle and in free-flowing sections of the river both upstream and downstream from the hydropower system. Snake River basin*

[12] A growing body of scientific evidence indicates that the northern Pacific Ocean was in a warm cycle from the mid 1970s to the mid 1990s. These warm conditions adversely affected salmon production in the Pacific Northwest. Current evidence indicates the northern Pacific Ocean is now cooling and salmon production is increasing (Hare and Mantua, 1999, p. 1; JISAO/SMA Climate Impacts Group, 1999, p. 14; Taylor, 1997 and 1999; Casillas, 1999; Espenson, 2000). As a result, management improvements over the past two decades may have been offset by poor ocean conditions. We may not know what is really working and what is not working. Kevin Friedland states the resulting issue succinctly: "*Management policy that is predicated on freshwater production trends and political trends and ignores decadal scale trends in ocean productivity is doomed to failure*" (Friedland, 1999).

> *fish evolved under conditions where the travel time of smolts through the lower Snake and Columbia Rivers was much shorter than presently exists. Thus, higher flows, while decreasing travel time, may also improve conditions in the estuary and provide survival benefits to juvenile salmonids migrating through the estuary or the Columbia River plume. By reducing the length of time the smolts are exposed to stressors in the reservoirs, higher flows also likely improve smolt condition upon arrival in the estuary*" (White Paper, p. 22, emphasis added).

This speculative description of the possible benefits of decreased travel time from flow management in the face of weak and inconsistent data is evidence that there is no rational basis for flow augmentation and that inclusion of such augmentation from the Upper Snake is arbitrary without supported careful analysis from the scientific evidence in the record. Careful analysis of the mechanisms, uncertainties, and quantification of these speculative indirect impacts is conspicuously absent. Moreover, survival is the issue, not travel time.

NMFS reports a strong association between travel time and flow and concludes that travel time is a function of flow (White Paper, pp. 12-17, 22). However, the correlation appears to be invalid due to a collinear relationship between flow and time of year (photoperiod).[13] Flows measured by the U.S. Army Corps of Engineers at Lower Granite Dam at 15-day intervals in 1995 and 1996 are given in Table 2. As seen in the table, there is a consistent increase in flow over time during the downstream migration of smolts. Both flow and photoperiod increased synchronously over the period of study. Thus, conclusions concerning flow as the variable controlling travel time are highly speculative.

An analysis of tagged juvenile hatchery chinook based on smolt migration through Lower Granite Reservoir from 1987 through 1995 concludes that photoperiod provides a

[13]Collinear means that the predictor variables (e.g., temperature, flow, travel time, and time of year) are highly correlated with each other. Thus, any correlation of the variables to the dependent variable (salmon survival) is confounded by the other variables.

better basis to predict travel time than flow, and that travel time can be predicted by flow only because the relationship between flow and time is collinear.[14]

Table 2. Flow at Lower Granite Dam.

Date	1995	1996
April 1	46 kcfs	81 kcfs
April 15	78 kcfs	132 kcfs
April 30	84 kcfs	98 kcfs
May 15	96 kcfs	139 kcfs
May 30	111 kcfs	156 kcfs
June 14	120 kcfs	170 kcfs

NMFS and other agencies should further evaluate potential collinear effects among variables before arriving at firm conclusions for yearling migrants. As discussed below for sub-yearling migrants (fall chinook), confounding effects probably exist from collinearity between flow and other environmental variables such as water temperature and turbidity. In addition, the relationship of survival to other independent variables such as the physiological state of the juveniles, size of the juveniles, predation, competition, and ocean conditions should be explored.

Quantitative estimates demonstrate that flow augmentation is ineffective even at maximum possible levels. Year to year, a small relationship between flow and SAR is evident in some stocks. However, the resulting benefits to the listed species are likewise small when considered in terms of actual range of flow increases that can be achieved with flow augmentation. Moreover, the correlation of survival with annual flows is not likely to equate to significant changes in survival from flow augmentation within a season. Nevertheless, consistent results reflecting minimal potential benefits from annual flow changes emerge from several analyses.

For example, the theoretical effect of flow augmentation on Snake River spring/summer chinook and steelhead SARs can be estimated through relationships of flow, water travel time (WTT), and SAR. Flow augmentation of 427 kaf from the Upper

[14] See Attachment B in the comments submitted by the Idaho water users on the draft White Paper submitted to NMFS on October 29, 1999.

Snake decreases WTT between Lower Granite and Bonneville by one-half day (Dreher, 1998, p. 12). Based on the correlation of SAR to WTT in Table 15 of the White Paper, this would only result in a change in SAR of about 0.04 for both steelhead and spring/summer chinook.

In other examples, augmentation from the Upper Snake River of 1 MAF could provide an 8 kcfs increase in flow over a two-month season.[15] A recent study determined that an 8 kcfs flow change might result in a change in SAR from 0.010 to 0.011 for four fall chinook stocks (Anderson et al., 2000). Similarly, using a mean flow of 150 kcfs in the mainstem Columbia River and the data in the White Paper, an 8 kcfs increase might equate to a change in SAR for Upper Columbia wild steelhead of 0.0155 to 0.0164. Only in the NMFS analysis for Marsh Creek spring chinook is there any discernable correlation of year-to-year flow to survival (NMFS 2000a). For that stock, the slope of the regression was relatively large with a change in the spawner-recruit ratio from 1.0 to 1.4 using an 8 kcfs increase on a 75 kcfs base. However, with respect to this one possible exception, if the Marsh Creek relationship were causative and widespread, the strength of the correlation would be evident in tremendous and obvious success from the past flow augmentation program. Instead, the continued decline of the stocks during the flow augmentation program is more in accordance with an insignificant or null effect of flow augmentation on adult survival.

Sub-Yearling Migrants (Fall Chinook)

A review of available data and recent research supporting and defending flow augmentation for fall chinook leads to the conclusion that Upper Snake River flow augmentation provides no significant benefit to survival of the listed species for the following reasons:

1. Flow augmentation should be the focus of analysis, not natural variations in flow. Upper Snake River flow augmentation provides no beneficial changes in important environmental variables such as date of migration, temperature, and turbidity.

[15] Of course, flow augmentation with 427 kaf can only provide about 27 days of a flow increase of 8 kcfs and a corresponding decrease in potential SAR changes.

2. Flow is a poor predictor of survival and the effect of flow on survival cannot be reliably estimated. Other environmental variables such as time of migration, water temperature, and turbidity are more strongly correlated with survival.

3. Survival is also more likely related to other independent variables such as the physiological state of the juveniles, size of the juveniles, predation, competition, and other factors.[16]

4. There is no statistically significant relationship between flow and spawner-recruit data for fall chinook over brood years 1964-1994.

Recent Studies Above Lower Granite Reservoir

There are serious flaws in recent biological research that is being used to support and defend flow augmentation to benefit ESA-listed anadromous fish runs. The published results of this research raise serious concerns about the methods being used in these studies and the conclusions drawn from the results. These concerns include the confounding effects from correlation between flow and other environmental variables such as photoperiod, water temperature, and turbidity. In other words, changes in survival appear to be in response to variables other than flow. Flows naturally decrease during the migration period for juvenile fall chinook. As discussed below, other variables also change during this same period, which can lead to spurious correlations of flow to survival (Anderson, et al., 2000).

The Draft BiOp assumes without comment that flow augmentation is beneficial under all conditions. The analysis by Anderson Hinrichsen and Van Holmes (Anderson et al., 2000) demonstrates that flow augmentation with warm water is detrimental to salmon smolts. This mistake reflects the *ad hoc* manner in which the science on flow was incorporated into the Draft BiOp. The White Paper, in a cursory analysis, determined that Hells Canyon flow is correlated with survival as are the other environmental variables such as temperature and turbidity. The Draft BiOp assumes that flow augmentation would then be beneficial to fall chinook smolts irrespective of any causative linkage. An extensive analysis of the fall chinook data by Anderson et al.

[16] See our October 29, 1999 comments on the draft White Paper and literature cited therein.

(2000) concluded otherwise; that Hells Canyon flow augmentation is detrimental to fall chinook.

Anderson et al. statistically demonstrated that during the season, migration timing and temperature are better predictors of survival than flow (later timing and higher temperatures reduce survival).[17] In fact, multiple correlation rejects seasonal flow as a predictor of survival. This means that within-season flow changes, such as through flow augmentation, are even less likely to be significantly correlated with survival than between-season changes. Anderson et al. further demonstrated that the correlation between flow and water temperature for Snake River flow augmentation can reverse from natural conditions so that flow augmentation increases Snake River temperature. Because temperature is likely to be a causative factor in the survival pattern (higher temperature increases predation), when augmentation increases temperature, it decreases survival. In other words, summer flow augmentation with warm, clear water from Brownlee decreases survival for Snake River fall chinook (Anderson et al., 2000, p. 58).

The cursory analysis of flow in the White paper and the *ad hoc* application of the results in the Draft BiOp results in a flow augmentation strategy that is not only ineffective, but in this case, is detrimental to fish. In fact, while the Draft BiOp seeks to increase Upper Snake River flow augmentation, the science suggests that in fact this augmentation should be eliminated.

SAR v. Flow

Anderson et al. (2000) evaluated spawner-recruit data for several index stocks of fall chinook for various brood year data sets extending back to the 1960s. No statistically significant relationship between natural variations in flow and recruits per spawner was found. Although not statistically reliable, a small positive relationship exists. However, even if additional data proves the relationship to be valid, the effect would not be biologically significant because the benefits of flow would be slight. Moreover, as

[17] The occurrence of higher flow also correlates with the occurrence of lower temperature and earlier migration (earlier release of fish). While temperature and migration timing correlate with survival, flow and travel time do not. However, since all of the variables change in synchrony, each factor individually correlates with survival.

discussed in the previous section, it must be emphasized that it is not clear that flow is the operative variable, and it is not apparent that flow augmentation provides any of the benefits of a naturally high-flow year.

Smolt-to-adult returns (SAR) or survival encompasses life stages between juvenile seaward migration and adult spawning. The high mortality during various life stages contributes to low SARs. For example, optimistic survival levels for fall (ocean-type) chinook are: spawning to juvenile migrant (≈ 0.115), juvenile migration (≈ .610), marine feeding (≈ .015), adult migration (≈ .600), and pre-spawning (≈ .950).[18] Total life cycle survival contributing to SAR can be approximated by multiplying the survival fractions, i.e., SAR ≈ 0.115 x 0.610 x 0.015 x 0.600 x 0.950 ≈ 0.0006. Thus, survival for juvenile migration (≈ 0.610) represents less than 1 percent of the total SAR. A similar example for spring/summer Snake River chinook also shows that the SAR for juvenile migrants (≈ 0.60) is a tiny fraction of total SAR (≈ 0.00014) (BPA et al., 1999, pp. 4-9 – 4-11). Thus, there is little prospect for associating SAR with environmental variables such as flow.

Finally, the Draft BiOp does not evaluate the effects of Upper Snake flow augmentation on the listed species. The analysis in the Draft BiOp uses the SIMPAS smolt passage model to assess the impacts of hydrosystem operations on smolts. However, because this model has no flow-survival component, the Draft BiOp cannot evaluate the impacts of flow management. Rather than quantitatively address the relative benefits of flow, if any, the Draft BiOp chose to rely on qualitative assertions.

JEOPARDY OPINION

This is the first BiOp in which NMFS has concluded that the operation of the Upper Snake BOR projects is likely to jeopardize the continued existence of these listed species or adversely affect their critical habitat (pp. 8-2 *et seq*). None of the previous BiOps contain such an opinion or conclusion – including the 1999 BiOp addressing the Upper

[18] See Attachment 4 to the Idaho water users comments on the draft All-H Paper, which can be found at http://www.nwppc.org/recommend/recommend.htm.

Snake BOR projects that was released just seven months prior to this Draft BiOp. No relevant new data or analysis is provided on the specific effect of these projects on the listed species or their habitat. Thus, the jeopardy opinion on operation of the Upper Snake BOR projects has no basis. The only logical explanation, and one that is suggested in the analysis, is that the conclusion derives from the decision to simultaneously consult on all 43 projects — some of which have been previously determined to cause jeopardy (FCRPS projects) and others which have only been part of a mitigation or recovery strategy (including the Upper Snake BOR projects).

It is deeply disturbing that the Draft BiOp concludes that the Upper Snake BOR projects cause jeopardy while providing the 427 kaf of flow augmentation called for in previous BiOps. There is no evidence that the historical operation of the projects would cause jeopardy, let alone when operated to provide flow augmentation water. Indeed, the original reason for providing 427 kaf was to mitigate jeopardy caused by the FRCPS. Yet, now NMFS concludes in the Draft BiOp that operating the Upper Snake BOR projects to provide flow augmentation will jeopardize the species.

If NMFS is now concluding that the Upper Snake BOR projects cause jeopardy, then that conclusion appears to be based solely on the depletion analysis in the Draft BiOp (pp. 6-27 to 6-30). The implied logic is that these projects significantly deplete the downstream flow during the migration/flow target season and that those depletions adversely affect the survival of the listed species or their habitat. As discussed in the previous sections, the hydrological and biological underpinnings of the flow alteration hypothesis for jeopardy caused by the Upper Snake BOR projects are not sound. There has been virtually no change in the volume of historical outflow from the Upper Snake, flows have increased during the critical summer period, and there is no scientific basis for the conclusion that Upper Snake flow augmentation from BOR projects will benefit the listed species or their habitats.

In fact, the Draft BiOp itself questions the logic of the depletion analysis. Although asserting that "flow depletions caused by BOR-based irrigation activities are a major impediment to meeting NMFS' flow targets" the text goes on to recognize the BiOp analysis as "speculative" (p. 6-28). After acknowledging that water law would allow other appropriators to take much of the supply made available by altering BOR operations, the Draft BiOp concludes "therefore, although the following analysis attributes substantial streamflow depletion effects to BOR project operations, it is not clear that BOR could, with any reasonable degree of certainty, avoid these effects" (Id.). A jeopardy opinion without certainty and based on speculation fails to meet, by definition, the standard of reliance on the best scientific data available required by Section 7(a)(2) of the ESA. Moreover, such an opinion has no rationale basis, and is arbitrary.

UPPER SNAKE REASONABLE AND PRUDENT ALTERNATIVES

The Draft BiOp lists six RPAs that apply to the Upper Snake BOR projects: pursue flow targets; provide 427 kaf of flow augmentation using powerhead space if necessary; consult on uncontracted space; improve water conservation; address unauthorized uses; and negotiate for additional water (pp. 9-35 to 9-54). Each of these RPAs is addressed below.

As a general matter, Idaho water users oppose continued Upper Snake River flow augmentation because there is no evidence that the release of an enormous volume of water over the past 14 years has contributed to the survival of Snake River spring and summer chinook, steelhead, or sockeye populations, or any other listed species.[19] Development of water resources in the Upper Snake River basin did not cause the decline of fish populations and has not resulted in the destruction or adverse modification of critical habitat. Continuing to reduce Upper Snake River water uses to provide flow augmentation will not reverse the fish population decline, recover the populations, or mitigate the adverse modification of critical habitat caused by activities in the lower Snake and Columbia Rivers.

As discussed above, there is no legal or factual basis that the Upper Snake BOR projects cause jeopardy to the listed species or adversely affect their habitat. As such, there is no basis for justifying these actions for the Upper Snake BOR projects as

[19] From 1986 through 1999, flow augmentation from Idaho has involved 3.4 MAF from the Upper Snake, 2.3 MAF from Brownlee, and 13.5 MAF from Dworshak for a total of 19.2 MAF from Idaho.

reasonable and prudent alternatives to their very existence and operation. At most, these actions should be characterized as offsite measures intended to mitigate the incidental take caused by FRCPS operations.

Lower Granite Flow Targets Are Unreasonable and Unfounded

Table 3 contains the NMFS' flow objectives in the Draft BiOp for the Snake River at Lower Granite Dam (p. 9-40). These flow objectives are the same as those set forth in the NMFS' 1995 and 1998 BiOps on operation of the FCRPS.

Table 3. NMFS flow objectives, Snake River at Lower Granite Dam.

Spring (4/3 – 6/20)	85-100[†] kcfs
Summer (6/21 – 8/31)	50-55[†] kcfs

[†]Varies based on water volume forecasts.

The basis of the flow targets in the 1995 and 1998 BiOps is set forth in a 1995 report by NMFS (NMFS, 1995). The White Paper supplants the 1995 report as the hydrological and biological basis for continuation of the identical flow targets in the Draft BiOp.

As discussed below, the flow targets at Lower Granite Dam are unreasonable because they cannot be reliably met and do not reflect the wide natural variation in flows. Those flow targets are unfounded given that flows remain similar to or are better than historical conditions and there is no biological basis for the flow objectives.

The RPA for flow augmentation from the Upper Snake is largely driven by the desire to meet the flow targets at Lower Granite Dam and farther downstream (p. 9-39). However, these seasonal flow targets identify flows that cannot be achieved on a reasonable or frequent basis. For example, under the Draft BiOp analysis, the flow targets are <u>never</u> met in August and would only be met 8 percent of the time if all Upper Snake BOR projects did not deplete any flows.[20] Flow targets that can be met seldom, if ever, are unreasonable by definition. Indeed, the goals of increasing spring and summer

[20] As discussed elsewhere in these comments, the impact of Upper Snake BOR project depletions are overestimated and any flow benefits are speculative. Moreover, if the BOR projects did not deplete flows, senior irrigators would be able to do so under state water law.

flows while limiting winter/spring drawdown and increasing the probability of reservoir refill are mutually exclusive and hydraulically impossible.

As described earlier in these comments, flow objectives are not necessary at Lower Granite because current flows are approximately equal to historical flows in both amount and timing. This is particularly true during the summer when irrigation return flows have increased the amount of water leaving the Upper Snake. Indeed, the 1999 BiOp on the Upper Snake BOR projects recognizes that average streamflows at Lower Granite in August are virtually identical under natural flow conditions and current conditions (1999 BiOp, p. 27). Given that the average flow in August at Lower Granite has always been around 31 kcfs, there is no basis for NMFS' current flow target of 50 to 55 kcfs and the BOR should not be required to provide water from the Upper Snake basin to meet this unrealistic, and unjustified, objective.

Another perspective on the unreasonable level of the flow targets is evident from the fact that enormous volumes of flow augmentation from southern Idaho would have been needed to meet those targets, especially in dry years—over 10 MAF would have been needed in 1977 and 1992, or nearly the total storage capacity of the largest 80 reservoirs in the Snake River basin (Dreher 1998, p. 13).

Furthermore, the flow targets are also unreasonable in light of the enormous natural variation in runoff. A range of 5 to 15 kcfs in the low to high ends of the flow targets does not properly reflect that the range of Snake River flows at Weiser varies 350 percent from year to year (1999 BiOp, p. 25; see also Figures 2 and 6 in these comments).

Most importantly, the flow targets have no clear biological basis. As discussed in previous sections of these comments, there is no relationship between survival and flows through the hydrosystem within a season. Above Lower Granite, the purported relationship between fall chinook survival and flow is statistically unfounded. Indeed, Upper Snake flow augmentation is detrimental to fall chinook survival. Relationships noted in the Draft BiOp relating flow or travel time to higher smolt-to-adult returns (SARs) are not valid with respect to Upper Snake flow augmentation.

Flow Augmentation Using 427 kaf or More, and the Use of Powerhead Space, is Unnecessary and Illegal

As thoroughly discussed in the comments above, there is no scientific evidence that flow augmentation from the Upper Snake will provide significant hydrological or biological benefits to the listed species and their habitat. Thus, flow augmentation from the Upper Snake BOR projects is unnecessary. Furthermore, the Draft BiOp's RPA for the Upper Snake BOR projects ignores several aspects of Reclamation law and Idaho water law.

NMFS instructs the BOR to annually provide 427 kaf irrespective of the authorized purposes of the BOR projects involved (p. 9-48). A prime example is the requirement to use powerhead water to provide flows during drought (p. 9-49).

Each of the projects in the Upper Snake River basin was built pursuant to specific Congressional project authorizations. The authorized purposes of the projects are dictated by those Congressional authorizations. The primary authorized purpose in each case is to supply irrigation water. Only some of these projects are authorized to serve fish and wildlife purposes as a secondary priority. A discussion of the authorized purposes for each Upper Snake BOR project should be contained in the final BiOp and the Action listed at the bottom of page 9-48 should be revised to read "… pursuant to state <u>and</u> <u>federal</u> law…"

One of the authorized purposes of the Minidoka and Palisades Projects is power production. Contrary to this authorized purpose, NMFS requires the BOR to use water released from powerhead space in the event that the 427 kaf cannot be acquired by other means (p. 9-49). There are legal constraints that prohibit this use. In the Upper Snake projects that have a power component, the development of power was necessary for the irrigation of the lands under the reclamation project and the power generated by the reclamation project is reserved for use on that project. In 43 USC §522, Congress has clearly provided that neither surplus power or power privileges will be used so as to impair the efficiency of the irrigation project. The cost of power is based upon the cost of production. Powerhead space is used to provide hydraulic head for the generation of power. Without this hydraulic head, the efficiency of generating power is reduced or generating units will not operate properly and must be shut down. In turn, the increased costs for power directly affect the efficiency of the irrigation project by increasing costs.

On the other hand, if this proposed use is based upon the premise that the powerhead water is "surplus," 43 USC §521 provides that the BOR must obtain the approval of the spaceholders in the storage facility for release of that water. This section of the code further provides that such water shall not be released for other uses if the delivery of such water is detrimental to the water service of the irrigation project. When powerhead space is released, carryover storage is reduced and the potential for refill is affected. No approval by the spaceholders has been obtained by the BOR. In fact, the BOR has been placed on notice that such use is unauthorized and the water users may be damaged by such unlawful use.

In addition, the storage and distribution of water in each of the Upper Snake BOR projects is controlled by a state water right issued by the State of Idaho for such uses, as required by the Reclamation Act of 1902. The BOR does not have discretion to use the storage and distribution facilities without regard to state law. In terms of powerhead space, the state water right for the projects does not allow for release and refill of the space. In addition, Idaho Code Section 42-1763B, which provides state law authority for the BOR to make salmon water releases, does not include powerhead water.

Under Section 7 of the ESA, the BOR is only required to take those actions that are within the agency's authorities to accomplish (16 U.S.C. Sec. 1536(a)(1)). The ESA does not create new authority or repeal existing authorities. The BiOp must set forth the authority under state and federal law, if any, for the BOR to release powerhead water. In the absence of such authority, this element of the RPAs for the Upper Snake must be deleted.

Consultation on Uncontracted Space

The Draft BiOp requires the BOR to consult with NMFS before entering into any agreement with respect to uncontracted space in order to identify potential additional supplies for salmon water (p. 9-50). However, as discussed in the previous section, any change in the use of this space must be consistent with Reclamation law and state water law. Due consideration should also be given to the environmental, economic and social impacts of such changes.

NMFS sets forth a policy of "zero net impact [from any BOR commitment to a new contract or contract amendment to increase the authorized use of water] on the ability to meet the seasonal flow objectives established in this Biological Opinion" (p. 9-51). Given the unrealistic summer flow target at Lower Granite (50 to 55 kcfs), this virtually guarantees that there will be no further development with water from Bureau reservoirs.

As discussed previously in these comments, the correlation between irrigated acreage and flows from the Upper Snake is weak to non-existent and does not justify NMFS' policy in this area. For example, the 1999 BiOp notes that the number of irrigated acres in Idaho has decreased by 215,000 (6.2 percent) since 1978 and the amount of land receiving water from Bureau projects has decreased by 26,000 acres or about 1.6 percent (1999 BiOp, p. VII-1). However, there has been no significant increase in flows and the fish populations have not rebounded. Moreover, these changes should be factored into the "zero impact policy." At a minimum, all existing water uses from Upper Snake BOR projects should be allowed to continue and Idaho should be allowed to return to the 1978 level of irrigated acreage.

In terms of environmental, economic, and social impacts from changes in the use of uncontracted space, the BOR should be required to request assistance from the U.S. Fish and Wildlife Service, the Idaho Department of Fish and Game, and the State of Idaho to evaluate the impacts from any changes in uncontracted space. Uncontracted space in reservoirs above Hells Canyon is currently used for a variety of non-irrigation purposes (e.g., conservation pools, mitigation, reservoir evaporation and streamflow maintenance). NMFS should not attempt to force reallocation from existing needs to flow augmentation.

We request that the provision for consultation on uncontracted space be modified to clarify that any BOR action with respect to uncontracted space should be consistent with state and federal law and that consultation be expanded to include all affected agencies and stakeholders.

Upper Snake Conservation Will Not Increase Streamflow

The Draft BiOp identifies water conservation through improved irrigation efficiency as a reasonable and prudent alternative to increase the water available for instream flows (p. 9-51). However, on an annual basis, the flow from the Upper Snake River would not be significantly increased by changes in irrigation efficiency because water losses from irrigation inefficiency already return to the river above Hells Canyon (Reclamation, 1999, pp. 3-4). Moreover, increased efficiency is likely to reduce return flows during the summer months—a time when the Draft BiOp indicates that additional flows are needed. Also, as alluded to in the Draft BiOp, in most cases, the “conserved water” would be used by the next junior water user downstream and the water would not become available for flow augmentation. There is no mechanism in Idaho law to “protect such water from diminishment” because these junior water rights are valid rights. As a result of these undisputed facts, there is no basis for this Upper Snake RPA and it should be deleted from the BiOp.

Addressing Unauthorized Uses

NMFS asks the BOR to investigate the unauthorized diversion and use of BOR-supplied water (p. 9-51). NMFS foresees that the BOR will need to take a contract action that will result in an additional opportunity to consult under Section 7. However, many of these occurrences may not be contract violations over which the Bureau may have authority, and may be a valid exercise of state water rights. The distribution of water is controlled by state law, as clearly set forth in Section 8 of the Reclamation Act. Only the State of Idaho has authority to commence enforcement actions for the unauthorized use of water. Again, this RPA should be eliminated from the BiOp as clearly being beyond the scope of the BOR’s existing authority.

In any event, such action is unlikely to yield additional water for downstream use for the same reason as water conservation — the water will simply accrue to the benefit of a junior water right holder.

Negotiation for Additional Water

The Draft BiOp calls for negotiations to increase the supplies of water available for flow augmentation from willing sellers and lessors (p. 9-53). However, the interim and experimental use of Upper Snake flow augmentation should be ceased, not expanded. As thoroughly discussed above, flow augmentation from the Upper Snake BOR projects does not provide significant biological or physical benefits to the listed species or their habitat. Adding more water will not provide benefits.

Correctly, the RPA acknowledges that such additional supplies need to be obtained through state law mechanisms. Renewal of state authority for large blocks of flow augmentation is highly unlikely; even if it occurred, there may not be water available ever year. Any attempt to force water to be released from the Upper Snake River basin involuntarily will be vigorously opposed.

Resident Fish and Wildlife, Economic, and Other Impacts

In evaluating the Upper Snake RPAs identified in the Draft BiOp, there is no evidence that NMFS considered resident fish and wildlife species, economics or other local impacts in the Upper Snake basin resulting from the alternatives NMFS that asserts are both “reasonable and prudent.” Without evaluating these impacts, there is no assurance that flow augmentation is either reasonable or prudent. Flow augmentation from the Upper Snake lowers reservoir levels, changes stream flow conditions, impacts other endangered species, and affects water quality both in the reservoirs and downstream. Moreover, the BOR has identified numerous socioeconomic impacts associated with efforts to acquire water for flow augmentation, including direct costs to agriculture, hydropower, recreation and municipal uses, secondary economic impacts, and changes in social well being (U.S. Bureau of Reclamation, 1999). The proposal for flow augmentation is a major federal action significantly affecting the quality of the environment and a NEPA analysis on the impacts of these Upper Snake mitigation actions is required before these measures can be demanded by NMFS. The scope of the NEPA analysis must include impacts of the alternatives (including a “no action” alternative) on resident fish and wildlife populations, recreation, power generation at the Upper Snake BOR projects, water quality, and socioeconomics.

PERFORMANCE STANDARDS

A number of the performance standards set forth in the Draft BiOp are flawed. These hydro, biological, and physical standards are the measures with which NMFS will assess progress toward survival and recovery of the species and will adjust, if necessary, its RPAs over the next decade.

The FCRPS hydro standard for juvenile passage (Table 9.2-2 of the Draft BiOp) is based on the combined survival in fish transport, in-river passage, and any delayed mortality of the transported fish. An adult standard is also given in Table 9.2-2. In addition to the hydrosystem survivals, minimum additional improvements in life cycle survival are identified to meet the jeopardy standard after achieving the aggressive hydro survival levels (Table 9.2-3). These hydro performance standards are not clearly defined and are unlikely to be measurable within the 5- to 10-year time frames for re-evaluation.

The biological performance standards based on population growth and survival are unreachable under realistic levels of population growth. Three biological standards are identified but they are not connected so all three must be achieved individually.

Physical performance standards are described as target levels for items such as flow and water quality. The physical performance standards are unconnected to population performance or survival, are likely to be ineffective, and may be detrimental to fish. Because the physical standards are established in terms of targets, there is no mechanism to assess their effectiveness or optimize their use. These issues are discussed in the following sections.

Hydro Performance Standards

A number of problems make the hydro standards unusable. The hydrosystem measure is a “total system survival” standard including transportation, in-river survival, and delayed mortality. The NMFS-derived total system survival uses a mixture of NMFS and PATH formulas. The overall approach would be clearer if NMFS had simply used the PATH formulation for system survival and transportation percentages. Also, the NMFS approach only provides approximations because it assumes that fish are only transported from Lower Granite. A more critical issue is that the estimation of the differential delayed mortality ("D" value), extra mortality, and system survival are problematic. NFMS used average values from the passage models developed in PATH, and *ad hoc* and unsupported passage estimates to estimate these factors. These problems are critical because these factors determine whether fish are recovering as a result of various actions or if the recovery is a result of natural changes in ocean conditions.

Using average results from the two passage models used in PATH produces unclear results. First, the conclusions from the two passage models are mutually exclusive. Using the FLUSH model, mortality is high in the hydrosystem and there is no trend in extra mortality. Using the CRiSP passage model, the extra mortality occurs concomitant with the Snake River dams and the shift in ocean conditions. Furthermore, NMFS' PIT-tag survival studies discredit the FLUSH model. If NMFS chooses to ignore these important facts in its use of PATH results, it must reanalyze the data using a single model that is supported by the PIT-tag data. A second alternative is to apply its own SIMPAS model and re-evaluate the differential delayed mortality or extra mortality. In either case, NMFS' approach of ignoring its own data and averaging fundamentally different models cannot be supported.

NFMS does not describe its methods to evaluate how extra mortality and total system survival change over the next 5 to 10 years. The Draft BiOp states:

> "That is, if conditions during the two periods are similar, then some factoring may be necessary to ensure that the progress evaluation is truly assessing progress of actions undertaken and there results are not masked by ambient conditions (e.g. environmental or hydrologic)." (page 9-11 of the Draft BiOp)

However, the factors of extra mortality and delayed mortality are inextricably bound to environmental and hydrologic factors. It appears that NMFS does not detail a method for assessing progress because it has not addressed the complexities of the issues. Furthermore, averaging results from PATH is an imprudent approach that does not resolve the complexities of fish recovery.

Total system survival includes a factor for differential delayed mortality ("D"), which depends on the D factor developed in PATH to quantify the level of extra mortality experienced by transported fish relative to fish passing in-river. The value of D estimated by NMFS is 0.63 with a confidence interval spanning from negative numbers to greater than 2 (NMFS 2000b). The aggressive RPA will yield a total system survival that is within a few percent of the current "total system survival." For example, from the NMFS BiOp spreadsheets, the base period system survival from 1980 through 1991 is 47 percent, the current period (1994-1999) is 56.0 percent, and the aggressive hydrosystem actions project a system survival of 56.7 percent (NMFS 2000c). Given that the range in D confidence intervals is 100 percent, the 0.6 percent difference between current and a target survival is insignificant. How will NMFS use such a measure to assess hydrosystem performance?

The D value is a highly-calculated and theoretical term with an unknown ecological foundation. It could reflect additional stress that fish experience in transportation or it could be just the opposite, where both weak and strong fish survive transportation and the weak fish naturally die after transportation. In contrast, the weak fish could be culled prior to their arrival in the estuary during in-river passage. Thus, the level of D can be interpreted as a problem with transportation or it may reflect the natural distribution of weak and strong fish in the population. The hydro standard, which is a trigger and criteria for assessing dam removal and other actions, tacitly assumes that D reflects a problem in the transportation system. This uncertainty in mechanisms associated with D creates a serious problem with using total system survival as a performance measure. Simply put, it is unclear whether the measure reflects natural or anthropogenic factors but the change in the D value is being used as a measure of the success or failure of the anthropogenic factors.

Another problem with the hydro standards lies in the SIMPAS model being used to evaluate the effect of hydro actions. The stated purpose of the model is to assess passage through various routes based on empirical data. However, this simplistic model ignores the effects of year-to-year and seasonal variations in supersaturation, temperature, and flow on fish passage and survival. Thus, the SIMPAS model cannot assess the impacts of water quality and flow measures on smolt survival.

Biological Performance Standards

The biological standards are unattainable and immeasurable. Also, it is unclear how the multitude of survival standards will be used in the decision-making process.

The biological standards are based on the percent improvement in population expressed as “lambda.” The underlying mathematical and ecological basis of the approach, the estimation of the parameter values in the models, and the use of a limited historical dataset to extrapolate long-term performance of the stocks are problematic. The technical difficulties are evident in the scientific debate on how to formulate lambda. The CRI group has presented various techniques for formulating lambda, has made a number of errors in the development of the values, and has been remiss in providing confidence estimates with the estimated numbers. In lieu of stating the confidence interval of lambda, the BiOp gives best- and worst-case estimates of the improvement in lambda that are required to meet the standards. The resulting range of estimates is problematic for several reasons. At one end of the range (the worst-case where large population growth is needed to achieve recovery), the estimates equate to some stocks increasing to levels approaching the entire Columbia/Snake River population (Hinrichsen, personal communication). On the other end of the range, the best-case estimates indicate that no improvements are required to meet all standards. However, even in the best-case conditions, the Draft BiOp would still require that the hydro and physical performance standards be met.

Projections of lambda over a century are misleading and inappropriate. To estimate lambda, NMFS only used data after 1980 while the PATH analysis used the data series back to the 1950s. The interpretation of the PATH analysis became highly controversial because the analysis could not separate the effects of long-term changes in ocean productivity from the effects of the Snake River dams. In an attempt to avoid this controversy, NMFS ignored data prior to the construction of the Snake River dams. However, this strategy has serious consequences. The brood years 1980 through 1994 (the last full brood year in the NMFS analysis) experienced some of the warmest North Pacific conditions, which resulted in some of the lowest productivities for all Northwest salmon. This analysis tacitly assumes that the 15 years of historically poor ocean conditions between 1980 and 1994 will characterize the next 100 years. In reality, the NMFS projections represent the worst-case conditions. In addition, the lambda analysis treats temporal changes in productivity by assuming changes are random and not cyclic; therefore, it consistently underweights recent improvements in productivity, whether they are from natural causes or the result of recovery actions.

The wide range and large variance of lambda estimates indicate that it will be difficult to reliably estimate changes in lambda for progress evaluations in 2005 and 2008. Due to the major problems in the formulation and measurement of the biological standards in the Draft BiOp, those standards must be revised.

Physical Performance Standards

The physical standards are inefficient and, in some cases such as with the flow targets, they are unrealistic and unfounded. The physical standards (including flow targets, tributary habitat, sediment input, and water quality) are disconnected from each other as well as other performance standards. Therefore, success from natural processes or other actions that lead to recovery will not be considered in the physical standards. For example, under the structure of the physical standards, water resources will be wasted trying to meet flow targets if other RPAs or changes in ocean conditions result in sufficient improvement in survival of the listed species.

As discussed elsewhere in these comments, the flow targets, especially at Lower Granite, are unrealistic given that they cannot be reliably met. In addition there is no scientific basis for those targets.

ADDITIONAL HARVEST RESTRICTIONS ARE A MORE EFFECTIVE WAY TO CONSERVE FALL CHINOOK

It is hard to think of a more perverse policy than to allow the harvest of substantial numbers of listed fish, particularly as they come upriver to spawn. The Idaho water users are not aware of any other species listed under the ESA where regular harvest within the boundaries of the United States is allowed. Adults that are killed on their way upstream have survived the life stages with the two largest components of mortality — incubation/rearing and ocean feeding — only to be taken a short time before spawning.

The Draft BiOp suggests that there is potential to improve survival of the listed species by further reductions in harvest (p. 9-115). Idaho water users strongly support aggressive harvest strategies, options, and actions, especially with respect to fall chinook. Minimizing harvest is extremely cost effective relative to the enormous investments and tremendous uncertainties associated with the hydropower (flow augmentation or breaching), habitat, and hatchery options.

With respect to fisheries, Idaho water users strongly support pursuit of harvest reform through the use of selective fisheries, alternative methods and gear, and increasing harvest in terminal areas (p. 9-116). We believe that these alternatives can provide Tribal fishing opportunities while still reducing the impact of harvest on listed species.

A substantial number of listed species continue to be harvested in the ocean and the mainstem Snake and Columbia Rivers. In-river harvest rates for Snake River spring/summer chinook have ranged from 3 to 8 percent in recent years (Marmorek et al., 1998, p. 14). Snake River fall chinook are subjected to heavy fishing pressure (NRC, 1995, p. 82; Marmorek et al., 1999, p. 15). Table 4 shows combined ocean and river harvest rates of up to 75 percent for fall chinook (Peters et al., 1999, p. 71; see also NRC, 1995, pp. 81, 82).

Reducing harvest rates will improve the probability of recovery by 100 percent or more (Peters et al., 1999, pp. 197, 198).

Table 4. Fall chinook exploitation (harvest).

Run Year	Mainstem (Columbia and Snake Rivers) Exploitation Rate		Ocean Exploitation Rate by Age				
	Jack	Adult	2	3	4	5	6
1986	0.055	0.469	0.015	0.106	0.170	0.169	0.303
1987	0.037	0.560	0.037	0.156	0.140	0.159	0.169
1988	0.046	0.524	0.027	0.060	0.288	0.172	0.159
1989	0.026	0.432	0.038	0.151	0.233	0.227	0.172
1990	0.028	0.452	0.042	0.059	0.271	0.252	0.227
1991	0.044	0.276	0.026	0.051	0.138	0.212	0.252
1992	0.051	0.166	0.020	0.095	0.242	0.204	0.212
1993	0.050	0.254	0.006	0.079	0.244	0.204	0.204
1994	0.033	0.155	0.015	0.014	0.229	0.204	0.204
1995	0.025	0.115	0.016	0.047	0.074	0.169	0.204
1996	0.039	0.171		0.046	0.000	0.158	0.169
Mean	0.039	0.325	0.024	0.079	0.184	0.194	0.207
Min	0.025	0.115	0.006	0.014	0.000	0.158	0.159
Max	0.055	0.560	0.042	0.156	0.288	0.252	0.303

The goals for improving hydrosystem survival are small and, as discussed previously in these comments, it is impossible to measure any incremental change that may be related to Upper Snake flow augmentation. However, the effect of harvest reduction can be clearly identified and the harvest reduction equivalent to the potential benefits of flow can be shown to be small and insignificant. To demonstrate the equivalence between small harvest reductions and large flow increases, we apply the approach developed by Norris (1995, 2000). Norris used the Pacific Salmon Commission Chinook Model to define equivalent harvest reduction policies for endangered Snake River fall chinook salmon. Because the stocks are harvested in a gauntlet of mixed-stock fisheries from Alaska to Oregon, the overall exploitation rate on Snake River fall chinook can be reduced by a variety of means, each of which has different economic consequences for the fisheries. Eight general types of policy alternatives were considered by Norris. Four policy options reduce harvest in specific geographic regions: the Alaska, British Columbia, or Washington and Oregon ocean fisheries, or the Columbia River fishery. Two policies reduce harvests in all regions in equal or scaled amounts; and two reduce harvests only in U.S. waters by equal or scaled amounts. Scaled policies reduce regional harvests in proportion to estimated regional catches of Snake River fall chinook during the period 1979 through 1993. Policies were deemed equivalent when the overall adult equivalent exploitation rate on the indicator stock (Lyon's Ferry Hatchery) was reduced by the same percentage. Equivalent policies were shown to be independent of assumptions about stock productivity.

Table 5 illustrates the tradeoffs between harvest and downstream survival by showing all possible solutions to reaching a specific escapement goal. In the Norris study, the goal was defined as 3,000 Snake River fall chinook spawners in year 2017. The model illustrates the change in harvest reduction to achieve the goal. For example, improving downstream survival 36 percent, reducing harvest by 60 percent, and improving upstream survival to 90 percent is equivalent to improving downstream survival by 360 percent, reducing harvest by 30 percent, and making no improvements in upstream survival.

Table 5. Downstream survival rates for various harvest rate reductions and prespawning survival rates required to achieve 3,000 spawners in year 2017. For example, if harvest rates are reduced by 30 percent, downstream survival rates would have to equal 0.582 (if prespawning survival is 0.6) or 0.364 (if prespawning survival is 0.9).

Percent Harvest Reduction	Prespawn Survival = 0.6	Prespawn Survival = 0.7	Prespawn Survival = 0.8	Prespawn Survival = 0.9
0	1.034	0.870	0.745	0.650
10	0.847	0.712	0.609	0.531
20	0.699	0.587	0.503	0.438
30	0.582	0.489	0.418	0.364
40	0.488	0.410	0.350	0.305
50	0.412	0.346	0.295	0.257
60	0.350	0.294	0.251	0.218
70	0.299	0.251	0.214	0.186
80	0.257	0.215	0.184	0.160
90	0.222	0.186	0.159	0.138

The relative benefits of flow augmentation and harvest reduction can be evaluated using Table 5 and the estimates of life cycle survival improvements with flow augmentation. Although not statistically significant, a correlation of Snake River fall chinook SAR with year-to-year flow estimated that 0.5 MAF of Upper Snake flow augmentation would change survival by 1.6 percent (Anderson et al, 2000). In other words, total system survival would increase from 24.4 to 24.8 percent using the estimate for Snake River fall chinook in the Draft BiOp (NMFS 2000d). Using Table 5, and assuming the lowest pre-spawning survival of 60 percent (which requires the largest change in harvest) the goal of 3000 spawners can be achieved by reducing harvest 82.6 percent with flow augmentation or by reducing harvest by 83.7 percent without augmentation. The average ocean and river harvest rate during the period used in the Norris analysis are 36 percent and 50 percent. Thus, the harvest rates to meet the 3000 fish goal with flow augmentation are 6.4 percent for ocean harvest and 8.9 percent for river harvest. Without the 0.5 MAF of Upper Snake flow augmentation, the rates are 6.0 percent and 8.3 percent.

Under these worst-case conditions (optimistic estimates of the effect of flow augmentation on survival and pessimistic estimates on the number of spawners), a further change in harvest rate of 0.5 percent is equivalent to the effect of the Upper Snake River flow augmentation. It is important to note these calculations assume that a flow survival correlation between year-to-year flows will become statistically significant and if so, the same increases in survival can be achieved using flow augmentation within a year. It also assumes that the statistically insignificant flow survival relationship is strictly due to the water flowing down the river when the fish are migrating. In actuality, many environmental factors are correlated with seasonal flow including ocean productivity and the over wintering conditions of the fish prior to their migration. Therefore, the actual harvest reduction needed to achieve the theoretical effect of flow augmentation is likely to be less than one-half of one percent.

Harvest reforms can provide significant benefit to the listed species, especially Snake River fall chinook. The RPAs listed for harvest in the Draft BiOp should be revised to require these reforms.

INCIDENTAL "TAKE" DOES NOT OCCUR FROM UPPER SNAKE PROJECTS

Operation of the Upper Snake BOR projects does not "take" listed salmon or steelhead. Without stating it directly, the Draft BiOp implies that operation and maintenance of these projects results in a "take" of listed Snake River salmon and steelhead. This is inherent in the "Incidental Take Statement" contained in the Draft BiOp (pp. 10-1 *et seq*). We strenuously oppose any conclusion that infers that Upper Snake BOR project operations result in a "take" under the ESA and therefore need to be authorized by NMFS.

Snake River salmon and steelhead habitat and the migratory corridor to the ocean are located far downstream of the Upper Snake BOR projects. These species have never existed above Milner Dam. The "take" that has occurred has been the result of downstream factors, as indicated in previous consultations on the Federal Columbia River Power System ("FCRPS"). The 1995 and 1998 Incidental Take Statements were for the FCRPS, not the Upper Snake BOR projects. In an attempt to mitigate the downstream impacts and pursue recovery of listed species, NMFS has required the BOR to provide 427 KAF from the Upper Snake River basin.

Given this relationship, NMFS properly concluded in the 1999 BiOp that the BOR's continued operation and maintenance of the Upper Snake projects will not jeopardize the continued existence of the species. It must be made equally clear that continued operation and maintenance of these projects will not result in any "take" of the listed species. This is a basic flaw in the Draft BiOp, which must be addressed.

MAGNUSON-STEVENS ACT RECOMMENDATIONS ARE PREMATURE AND FLAWED

Essential Fish Habitat (EFH) has not been designated for any of the listed species involved in the BiOp. Although EFH has been proposed for salmon and steelhead, the Secretary of Commerce has not yet acted. Thus, the analysis and recommendations on salmon habitat are premature.

The Magnuson-Stevens Act ("MSA") recommendations suffer from even greater deficiencies than the rest of the BiOp. First, the scope of the analysis is not clear. There is confusion as to whether the MSA recommendations are directed solely to FCRPS projects, or to the FCRPS and 29 additional BOR projects (compare Sections 12.2.1 and 12.3.1, pp. 12-5, 12-8). The rest of these comments assume that the Upper Snake BOR projects are included within the scope of the recommendations.

The Draft BiOp contains a litany of impacts from reservoir operations including changed streamflow conditions affecting turbidity and sediment transport, estuary conditions, seasonal flows, and the extent and characteristics of the Columbia River plume (pp. 12-8 through 12-11). Allegedly, these changes have led to migration delays, changes in water quality, new predator-prey dynamics, habitat impacts, and alteration of the distribution, abundance and diversity of organisms (Id.). Such broad statements require identification of the specific project creating those changes and the factual basis for such conclusions pertaining to that project. Like similar statements in the rest of the Draft BiOp, these conclusions cannot be substantiated with established facts as to the Upper Snake BOR projects. Without specific reference to particular projects and substantiation of the facts for those projects, such broad generalizations should be deleted from the BiOp.

The EFH conservation recommendations adopt the RPAs in Section 9 of the Draft BiOp. For the reasons discussed under the section of these comments on *Upper Snake Reasonable and Prudent Alternatives,* those recommendations are flawed and should be eliminated in the BiOp.

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ATTACHMENT 1:
COMMENTS ON FLOW WHITE PAPER AND REPLY TO NMFS RESPONSES

In many instances, the revised White Paper[21] is substantially improved over the September 1999 draft. Some of the discontinuity between the analysis of the data and the conclusions has been eliminated and many of the uncertainties in the relationship of flow to survival have been clarified. However, the Idaho water users still take issue with a number of items in the White Paper and disagree with some of the NMFS responses to our comments on the draft. Moreover, the discontinuity that previously existed within the White Paper now exists between the Draft BiOp and the White Paper, i.e., the Draft BiOp makes much stronger assertions of "fact" than does the White Paper, yet the Draft BiOp purports to rely on the White Paper's analysis.

One general comment is worth noting at the outset. We have made a concerted effort to direct our comments on the White Paper and the Draft BiOp only to flow augmentation from the Upper Snake River. The reciprocal is not true. The White Paper and Draft BiOp generally lump flow augmentation from all sources into the same analysis. Upper Snake flow augmentation must be considered separately from Dworshak's cool water releases and separately from the enormous volumes of water available from mainstem Columbia River reservoirs.

Many of our issues are addressed in the body of our comments on the Draft BiOp and will not be repeated here. Other comments on the final White Paper remain the same as those on the draft and are simply referenced here. The following comments follow the order of the items in the White Paper.

[21] White Paper: Salmonid Travel Time and Survival Related to Flow Management in the Columbia River Basin. Northwest Fisheries Science Center, Seattle, Washington. March 2000.

Introduction

We appreciate the recognition that "storage regulation changes are less pronounced in the lower Snake River than in the Columbia River" (p. 1).[22] We also agree that Snake River fall chinook "are particularly susceptible to changes in the thermal regime and they spawn and rear in the mainstem" (p. 2). However, juvenile migrant mortality is also sensitive to temperature (Anderson et al, 2000).

The discussion of how the dams are operated to attempt to meet the seasonal flow objectives is not applicable to flow augmentation from Idaho. The reservoirs in Idaho are drafted in the late spring and summer, not "primarily through limiting winter drafting and rates of reservoir refill." Particularly for the Upper Snake reservoirs, water used for flow augmentation has typically been stored to meet authorized purposes and would be used elsewhere if not released for flow augmentation — it is not simply a matter of adjusting the rate of outflow.

Physical Properties Of Water Affected By Flow

In our comments on the draft White Paper, we made a number of comments concerning the need for additional hydrological background and analysis in the White Paper. The response was as follows:

Our Original Comments (excerpts selected by NMFS): *"Flows from the upper Snake Basin are virtually the same as they were 85 years ago." IWUA p. 3 "... the flow quantity [from] the Snake River has not changed significantly over the past 85 years. Thus any changes [to] the estuary or ... plume are not the result of upstream development on the Snake River. Further, the [Snake River] flows required to make significant changes in the estuary ... are large ..." IWUA p. 4 "The White Paper should be substantially revised to incorporate a comprehensive review and discussion of the hydrology of the Snake and Columbia Rivers. Particular emphasis should be placed on the Snake River system where populations of the listed species of most concern are located."*

[22] In this attachment, page references refer to the White Paper unless otherwise noted.

NMFS Response: We concur that a better understanding of hydrology would be helpful. We did expand Table 1 to indicate how flows have changed over time in the Snake and upper Columbia Rivers. However, hydrology is not the focus of this paper. The focus is on studies that measure the reaction of salmonid populations to variable environmental conditions. We also need to dispel the notion that the Snake River stocks are of most concern. Eight other salmonid ESUs are listed as endangered or threatened in the Columbia River Basin. Upper Columbia stocks are worse off than Snake stocks (excluding Snake River sockeye salmon) according to the latest CRI extinction analyses. Further, flow from the Snake River itself, though, is not the only important factor for salmon survival; water velocity and temperature are also important. These factors have changed drastically as a result of development of the hydropower system, including on the Snake River above the confluence with the Clearwater (Ebel and Koski 1968). Although flows in the Snake River have not changed, travel time of migrants has increased significantly due to the development and operation of the hydropower system.

Our Reply: While we understand that the White Paper focuses on biological response to environmental conditions, a more thorough understanding of the environmental variables would assist in interpretation of the data. For example, the fact that flows from the Upper Snake River have not decreased over time and summer flows have increased should be a consideration when evaluating which of the variables may be the most important to the listed species, especially when all of major variables are highly correlated with each other.

We also understand that the Snake River stocks may not be of the “most concern” to NMFS. However, we still believe that a more comprehensive review and discussion of the Snake River hydrology is warranted given that much of the biological research on flow-survival has been conducted on the Snake River. Moreover, given the relatively small amount of storage in the Snake River basin in comparison to the entire Columbia basin, flow augmentation from the Snake River primarily has the potential to affect the lower Snake, not the lower Columbia. Thus, Upper Snake flow augmentation has little or no impact on the “worse off” Upper Columbia stocks.

We also agree that temperature is important. However as discussed in the main body of comments on the Draft BiOp**,** summer flow augmentation from the Upper Snake typically leads to warmer water downstream, not cooler. In the case of flow augmentation from the Upper Snake River, the dampening of temperature increases from increased volume that is described in the White Paper (p. 5) is overwhelmed by ambient air temperature.

While we believe that the relationships of survival to velocity and flow to travel time are unproven, flow augmentation can do little to alter velocity and travel time because of the enormous increase in cross-sectional area created by the mainstem dams.

Another NMFS response to this area of comment requires a reply:

Our Original Comment: *"... flow augmentation is futile to mitigate the velocity reduction due to dams on the lower Snake River ... More than 160 MAF would be required to restore pre-dam velocities."*

NMFS Response: Nowhere in the white paper is the unrealistic goal of affecting pre-dam water velocities through reservoirs considered. Also, flow augmentation can be used for purposes other than increasing water velocity, such as temperature regulation, decreased delay at dams, and increased spill. Additionally, each incremental improvement in flow helps to return the river to a more normative condition. The incremental effects of water withdrawal throughout the system have also changed the hydrology of the river from conditions under which the fish evolved.

Our Reply: Assuming that the response means that the White Paper does not suggest that the goal is to achieve pre-dam velocities, we acknowledge that no velocity goals are set forth. The purpose of citing the amount of water that it would take to achieve pre-dam velocities is to put the magnitude of the futility to significantly alter velocities in perspective. The White Paper does suggest that a link between velocity, travel time, and survival exists. Our point is that flow augmentation from the Upper Snake makes a miniscule difference in velocity.

Similarly, Upper Snake flow augmentation makes a miniscule difference, if any, to temperature regulation, decreased delay at dams, increased spill, or estuary and plume conditions. In fact, as discussed in the main body of comments on the Draft BiOp, summer flow augmentation from the Upper Snake is detrimental to Snake River fall chinook.

The argument that flow augmentation is needed to increase spill is particularly perplexing because the fraction of the river spilled during low and moderate flow conditions (when flow augmentation might be used to increase flows) depends on an operational decision, not the total flow in the river. In other words, the percentage of spill is independent of flow augmentation from the Upper Snake River.

There is no evidence that water withdrawals from the Upper Snake have had a significant incremental effect on the listed species or their habitat, or on "normative" conditions in the river.

Effects of River Factors - Spring Migrants

Our primary views on the effect of flow on spring migrant survival are set forth in the main comments on the Draft BiOp. However, our replies to NMFS responses on this issue are set forth below:

Our Original Comments: *"In recent years, the Raymond and Sims and Ossiander research has been discounted ... However, the studies criticizing the dated research are not even discussed or cited in the White Paper."*

> *"… older research that does not consider changes in the hydrosystem over time … is still relied upon."*

NMFS Responses: We don't use data from any of these studies to support our conclusions, therefore we do not make any effort to criticize these data.

Wherever possible, we updated past analyses of SAR or recruit-per-spawner data. Furthermore, the white paper relies mostly on the recent PIT tag data, collected under current conditions.

Our Reply: We are encouraged to hear that NMFS is no longer relying extensively on dated research.

Our Original Comment: *"… photoperiod provides a better basis to predict travel time [of Snake River spring chinook salmon] than flow …"*

NMFS Response: "This conclusion is based on an *ad hoc* analysis (comparing mean R^2 values) that would not measure up to scientific scrutiny. We do acknowledge that smoltification level (for which photoperiod is likely a surrogate) is important in determining migration rate, and we elaborate on this point in the new version of the white paper. This does not diminish the fact no study has *failed* to find a travel time/flow relationship for Snake River spring chinook salmon."

Our Reply: The literature presents diverse interpretations of observational data on variables which are observed to be statistically associated with the migratory behavior of juvenile salmonids. Statistical correlation between and among random variables is useful for making predictions and evaluating hypotheses. Like NMFS, we recognize that correlation is not causation. Controlled experiments are typically required to identify cause and effect relationships. In the case of the multiple variables that are related to flow, because the wide natural variation in those variables and the lengthy life-cycle of the listed species, controlled experiments are not likely to provide useful information in a reasonable amount of time. Thus, all interested parties must engage in ad hoc analysis, NMFS included. In such a case, it is even more important to focus on the ecological mechanisms that might explain correlations.

The onset and synchronization of smotification and migration to sea are regulated by environmental variables — primarily increasing day length and temperature. These exogenous factors operate after juvenile salmonids attain a threshold size. Smotification and migration to sea typically occur during a limited span of time, which is highly predictable and closely related to cyclical changes in day length (photoperiod) and water temperature. Temperature mediates the physiological response to photoperiod — inhibiting smotification at cooler temperatures and stimulating smotification at warmer temperatures. Other environmental factors such as lunar periodicity, barometric pressure, water turbidity and velocity, wind, and spring overturn in lacustrine waters may modulate migration activity within a given seasonal cycle.

In other words, statistical associations between smolt migration speed or "survival" and flow may be coincidental where variables exhibit collinearity or multiple collinearity. As discussed in our primary comments on the draft BiOp, flow, temperature, photoperiod, turbidity, and velocity are all collinear. It is incumbent on NMFS to look beyond simple correlations of flow and survival in order to examine the ecological implications of environmental variables.

In our original comments, we list studies that have failed to find a travel-time/flow relationship. For example, Skalski (1998) concludes that even though environmental variables fluctuate greatly, survival of cohorts of PIT-tagged juveniles released daily at Lower Granite Dam exhibit little change throughout the migration period.[23] He found survival between Lower Granite and Little Goose Dam tailraces to be "…remarkably stable over the course of the season" and observed no association between survival and daily flow or daily spill. Such studies are simply omitted from the White Paper and from the NMFS response to our comments.

Effects of River Factors — Summer Migrants

Extensive comments on the flow augmentation-survival issue for fall chinooks are set forth in the main body of comments on the Draft BiOp. Our replies to the NMFS responses to our comments on the draft White Paper and those of other commenters on are provided below:

Our Original Comment: *"Particularly troubling is the suggestion that temperature control be used to more closely approximate historical conditions. Most scientists caution against taking actions based simply on how closely they approximate pre-dam environment... In the pre-dam system, the vast majority of the fall chinook in the upper Snake River spawned above Brownlee Dam …"* and *"Another issue is that the existing*

[23] Skalski, J.R. 1998. Estimating season-wide survival rates of outmigrating salmon smolt in the Snake River, Washington. Can. J. Fish Aquat. Sci. 55:761-769.

outlet works from the dams in Hells Canyon are mid-elevation facilities. Although an extremely expensive retrofit of multi-level outlet works might be technically possible, it is not clear that the pool behind Brownlee Dam has significant temperature stratifications year-round."

NMFS Response: We concur; simply trying to mimic historical conditions is naïve. The goal is to restore threatened and endangered salmonid populations. As noted elsewhere, hydroelectric development in the upper Snake River has severely affected populations of fall chinook salmon to the point that their major freshwater habitat has changed. Returning to historical conditions is not relevant for these fish. However, previous research has shown that changes in water temperatures have changed the timing of fall chinook salmon spawning in the Snake River. Subsequent emergence of fry and growth is also delayed, in turn delaying the start of downstream migration. The later the fish migrate, the worse the passage conditions. Changes in temperature regimes from present conditions might lead toward more favorable conditions and higher survival of fall chinook salmon. Ebel and Koski (1968) showed that Brownlee Reservoir is highly temperature-stratified beginning in May.

Our Reply: Beneficial changes in the temperature regime are unlikely to result from Upper Snake flow augmentation. Regardless of the stratification of Brownlee, ambient air temperature plays a significant role in river temperatures downstream of Hells Canyon. As noted in our primary comments on the Draft BiOp, Ebel and Koski's study also shows that Upper Snake flow augmentation is detrimental to fish under some conditions.

Original Comments: *"There are a series of factors that potentially interact to determine the effect of flow on survival ..." Bouwes et al. p. 14 "... survival estimates were [not] used as a dependent variable in multiple regression; i.e., the combined or interacting effects of flow, spill, turbidity, and temperature were not examined as predictors of survival rate." Bouwes et al. p. 19 "…environmental variables act in concert and affect survival rates in biologically meaningful ways." USFWS p.3*

NMFS Response: We concur that there is potential for environmental factors to interact in their effects on survival. Multiple regression, particularly with interaction among independent variables, might improve model fits. However, in cases where univariate regressions over a number of years yield no significant relationships (e.g. regressions with Snake River spring migrants comparing survival estimates to flow exposure), we consider it doubtful that a multiple regression approach would uncover any new information. In the case of Snake River fall chinook salmon, with regressions of survival from release to Lower Granite on flow, temperature and turbidity exposure indices, the environmental variables are so highly correlated that a multiple regression analysis is highly unlikely to determine which factors are most important in determining survival. Nonetheless, we intend to explore multiple regression approaches in future analyses of these data. The only way to demonstrate some of these effects with a high degree of confidence is to conduct controlled experiments. Unfortunately, it is extremely difficult to define control and treatment groups that only differ in a treatment (such as flow augmentation). Within-season treatments would be difficult to conduct because of the protracted migrations of release groups. Year-to-year treatments would require many replications due to confounding effects. With these limitations in mind, we are required to use the best available information, which, at this point in time, is the results of survival studies. In the future, it may be possible to manipulate the system to limit the confounding effects of correlated variables.

Our Reply: We agree that multiple regression will not help the analysis of spring migrant relationships to environmental variables. With respect to fall chinook, we encourage you to replicate the analysis performed by Anderson et al. (2000) which rejected flow as a predictor variable. As noted above in these replies, controlled experiments are unlikely to provide relevant information in a timely manner.

Our Original Comment: *"... benefits of flow are justified with phrases like "data indicate," "would likely" and "may provide." Clearly these qualitative and subjective phrases are used because a relationship between flow and survival has not been quantified, nor is it likely to be quantified."*

NMFS Response: In ecological studies, it is rare that one can be certain beyond a doubt about any conclusion. Scientific judgment involves accumulating information through time and determining which conclusions are supported by the preponderance of evidence. It would be unfair to characterize something as certain when it is not. At the same time, lack of 100 percent certainty does not indicate that relationships do not exist. It is clear that salmon migrating downstream through the hydropower system do so under flow conditions that are different than those under which they evolved. This is particularly true once the fish get below Bonneville Dam. Suggesting more natural flows are better for fish is not inconsistent. It is not the role of science to make the management decision of when the costs of flows are too high to outweigh presumed benefits for the fish.

Our Reply: The "preponderance of the evidence" does not support Upper Snake flow augmentation. We agree that salmon are migrating downstream under altered flow conditions. However, we maintain that Upper Snake development had little or nothing to do with those changed conditions and Upper Snake flow augmentation will not significantly improve conditions downstream, particularly below Bonneville Dam. It is also not the roll of science to rely on platitudes such as "if some water is good, more is better." The ESA requires a scientific analysis from scientists, not a subjective analysis that "natural" is better.

Our Original Comments: *"... there does not appear to be a relationship between travel time and survival [for Snake River fall chinook salmon]. This strongly indicates that other river conditions ... may be more important to survival than simply the quantity of flow." ". . . .there is credible and important scientific evidence that temperature is the operative variable affecting survival, not flow."*

NMFS Response: The highly speculative nature of these comments is ironic given your criticism to NMFS for speculative conclusions. Alternative explanations should be held to the high standards you demand of NMFS. We discuss the effect of temperature and flow and provide text on potential effects of both on survival in the final White Paper.

Our Reply: We stand by our original comments. NMFS is in a poor position to criticize commenters for speculative suggestions when the comments are merely pointing NMFS to studies that do not support their conclusions. Under the ESA, an agency must consider all scientific evidence, not brush aside criticisms that disagree with NMFS conclusions as "equally speculative." NMFS has no license to speculate in developing its biological opinion. As set forth in our main comments on the Draft BiOp, we believe that our interpretations are supported by sound science and reasonable ecological mechanisms.

Our Original Comment: *"Although flow and survival exhibit a positive and linear relationship at low flows ..., the relationship is flat above 120 kcfs. ... This is a strong indication that whether the relationship is correlative or causative, it breaks down."*

NMFS Response: Our analyses contained in the white paper conclude that above 120 kcfs, the relationship between survival and flow flattens out. Nonlinear relationships and threshold phenomena in biology are very common. To say that the relationship "breaks down" because it is not strictly linear through its entire range is speculative. Further, most flow augmentation will occur at background flows below 120 kcfs. We also provide text discussing how high flows (in 1997) were probably detrimental to survival by flushing rearing parr out of the system before they were ready and increasing the debris load at the dams.

Our Reply: We believe that the issue of whether the relationship "breaks down" is moot. As discussed in the primary comments on the Draft BiOp, further research using multiple regression indicates that there is not a statistically-sound relationship between flow and survival.

Our Original Comment: *"... the White paper reports an investigator's [Connor et al. 1998] conclusions without noting fundamental problems with the research."*

NMFS Response: We reported results from a peer-review[ed] journal article and attributed the conclusions about the potential of flow augmentation to improve survival to the authors. Disagreements with scientific articles are properly addressed by writing a rebuttal article, submitting it to the journal for peer review, and having it published.

Our Reply: The purpose of the White Paper is to recommend policies for NMFS to use for management of the Columbia River ecosystem. The White Paper was obviously heavily relied upon in drafting the BiOp. To cite Connor et al. without comment or qualification suggests that the authors and NMFS endorse the conclusions. Simply because something survives peer review is no guarantee that it is relevant, accurate or sound. NMFS has a duty to critically examine all data submitted to it, to examine it for methodological flaws that might bias its outcome rather than to accept every published article. Surely NMFS does not suggest that it will automatically reject every disagreement with a scientific article that is not peer reviewed or published in a journal? Or, on the other hand, automatically accept any scientific article that is peer reviewed and published in a journal?

ATTACHMENT 2:

EXCERPT FROM BOR-TWIN FALLS CANAL COMPANY CONTRACT

ATTACHMENT 3:

RÉSUMÉS OF CONTRIBUTORS

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Appointment

Associate Professor (WOT), School of Fisheries
College of Ocean and Fisheries Sciences
University of Washington, Seattle, Washington 98195

Director, Columbia Basin Research
Columbia Basin Research
1325 - 4th Ave., Suite 1820
Seattle, WA 98101

Previous Appointments

Research Associate Professor, College of Ocean and Fishery Sciences, UW (1987-91)
Research Assistant Professor, College of Ocean and Fishery Sciences, UW (1983-87)
Research Associate, College of Ocean and Fishery Sciences, UW (1981-1982)
Visiting Scientist, Dept. of Biophysics, University of Kyoto, Japan (1981)
Visiting Scientist, National Institute of Oceanology, Ambon, Indonesia (1980-1983)
Visiting Scientist, Institute of Oceanographic Sciences, Wormley, England (1980)
Adjunct Assistant Professor, Marine Sciences Research Center, State Univ. of New York (1977-1980)
Principal Oceanographer, Fisheries Research Institute, UW (1979-80)
Oceanographer, Dept. of Oceanography, University of Washington (1969-1979)

Research Interest

Biomathematics, ecology, fisheries, oceanography, toxicology, fish protection at power plants, fish passage and life cycle modeling, animal and human behavior, decision processes, ecosystem modeling, fisheries decision support models for fish/hydropower interaction.

Recent Research

Hydro Project: Developing computer for management of Columbia River hydroelectric and fisheries agencies. The work involves building models and analyzing data on the migration and survival of salmon through the Columbia River system (CRiSP1) and the harvest of fish in the ocean and rivers (CRiSP2). The projects maintains computer models and database information accessible through the World Wide Web. The model are being used to assess management strategies for hydrosystem operations and fisheries management.

Model development has involved original work on fish migration and survival. A number of student thesis and dissertations have been developed through the project including a dissertation on fish migration (Zabel 1994), a dissertation on fitness in salmon life history strategies (Hinrichsen 1994), a thesis of optimum strategies for salmon (Beer 1996), effect of ocean conditions on early ocean survival of chinook salmon (Hyun 1996).

The model incorporates upstream adult migration, nearshore and estuary affects on juvenile salmon survival, and improved modeling of the impact of supersaturation on fish survival.

PATH Project: Participation in Plan for Analyzing and Testing Hypotheses (PATH) to evaluate the Snake River endangered species recovery plans.

DART Project: Providing public data integration to the public for more effective access, consideration, and application as well as participating in a regional information review and making recommendations to BPA.

U.S. Army Corps of Engineers Project: Developing analysis and computer models for the impact of gas bubble disease on migrating salmon. Analyzing the impact of reservoir drawdown on passage and survival of adult and juvenile salmon.

National Marine Fisheries Service Project:

Under this project a general fisheries lifecycle harvest model is being developed. It is anticipated that this model will be the foundation of salmon and possibly ground fish management models in the next decade. The model will be used in the salmon co-management activities and in evaluating impacts of human activities on endangered species.

Professional Memberships

Sigma Xi
American Fisheries Society
Resource Modeling Association

Workshop and Conference Organization Activities

- Organization committee for the Bonneville Power Administration Predator/Prey Workshop, Friday Harbor Laboratories, May 1989.
- Coordinator of the Bonneville Power Administration Survival Workshop, Friday Harbor Laboratories, Feb 1989.
- Session chairperson at the Conference on Fish Protection at Stream and Hydro-Power Plants Sponsored by Electric Power Research Institute, Oct 1987.
- Coordinator for Ecological Risk Assessment Workshop University of Washington, July 1987.
- Session chairperson at the Saanich Inlet workshop, Sydney British Columbia, Feb 1983.

Public Service

- Toured Tri-Cities, Walla Walla and Yakima with President Richard McCormick, 1998.
- Provided analysis and advice to the Snake River Endangered Species Recovery Team 1995.
- Associate Editor North American Journal of Fisheries Management, 1989-1990.
- University of Washington Saturday Alumni Lectures, Autumn 1989.
- Puget Sound water quality planning committee, ad hoc committee on nutrient studies, Mar 1987.

- University Task Force on Salmon and the Columbia River System - represent the UW in a group of faculty from the University of Idaho, Oregon State University, Washington State University and University of Washington with interests and expertise relating to the Columbia River system.
- Ravenna Creek Feasibility Study - joined with representatives of neighborhoods adjacent to Ravenna Creek and members of the Department of Landscape Architecture to consider the possibility of daylighting the creek from its source to Portage Bay and possible restoration of its salmon run.
- Provide testimony on salmon restoration at 19 hearing including US. Senate and House subcommittees and state (Oregon, Idaho, Washington) committees between 1995 and 2000.

Reviewer

- EPA Environmental Biology Review Panel
- NSF Biological Oceanography, Physiological Processes
- U.S. Geological Survey
- Natural Environmental Research Council, Great Britain
- EPA Cooperative research programs
- NSF Psychobiology
- Research and Evaluation Associates, Inc.
- Bonneville Power Administration to technical work group
- NSF Physiological Process section
- Oregon Coastal Salmon Restoration Initiative
- NMFS Endangered Species Act \review process for permit applications
- Various Scientific Journals

Expert Witness

Federal Energy Regulatory Commission Court - certified as a fisheries expert on issues of fish migration and dam passage

Honors and Awards

- College of Ocean and Fishery Sciences Distinguished Research Award 1996
- Research is included in the UW publication Pathbreakers: A century of Excellence in Science and Technology a the University of Washington (1997)
- Nomination for Computerworld Smithsonian Awards in programming for the CRiSP computer model, 1993
- Special Recognition for participation in the U. S. Fish and Wildlife Service Fish Passageways and Division Structures course in 1990
- Research Faculty Fellowship, College of Ocean and Fishery Sciences 1989
- Research Faculty Fellowship, College of Ocean and Fishery Sciences 1985

Selected Publications

Norris, J. S. Hyun, J.J. Anderson (in press) Ocean Distribution of Columbia River Upriver Bright Fall Chinook Salmon Stocks

Steel, E. A., P. Guttorp, J.J. Anderson and D.C. Caccia. (In press). Modeling juvenile migration using a simple Markov chain. Journal of Agricultural, Biological and Environmental statistics.

Anderson, J.J. 2000. A vitality based model relating stressors and environmental properties to organism survival. Ecological Monographs 70(3) 117-142.

Anderson, J.J. 2000. Decadal climate cycles and declining Columbia River salmon. In Proceedings of the Sustainable Fisheries Conference, Victoria, B.C," ed. E. Knudsen. American Fisheries Society Special publication no. 2x. Bethesda, MD. 467-484.

Helu, S.L., J.J. Anderson, D.B. Sampson. 1999. An individual-based fishery model and assessing fishery stability. Natural Resource Modeling. 12(2) 213-247.

Zabel, R.W., J.J. Anderson, and P.A. Shaw. 1998. A multiple reach model describing the migratory behavior of Snake River yearling chinook salmon (Oncorhynchus tshawytscha). Canadian Journal of Fisheries and Aquatic Sciences: 55:658-667.

Beer, W. N. and Anderson, J. J. 1997. Modelling the growth of salmonid embryos. J. theor. Biol. 189, 297-306.

Zabel, R. and J.J. Anderson. 1997. A model of the travel time of migrating juvenile salmon, with an application to Snake River spring chinook salmon. North American Journal of Fisheries Management, 17:93-100.

Anderson, J.J. 1996. Review of the influence of climate on salmon. In Plan for Analyzing and Testing Hypotheses (PATH): Final report on retrospective analyses for fiscal year 1996. Compiled and edited by ESSA Technologies Ltd., Vancouver, B.C.

Nemeth R. and J.J. Anderson. 1993. Response of juvenile salmon to light. North American Journal of Fisheries Management. 12:684-692.

Anderson, J.J. 1992. A vitality based stochastic model for organism survival. In Individual-Based Models and Approaches in Ecology: Populations, Communities and Ecosystems. Editors DeAngelis and Gross, Chapman Hall, New York. p 256-277.

Anderson, J.J. 1991. Fish Bypass System Mathematical Models. WATERPOWER 91, Proceedings of the International Conference on Hydropower. July 24-26 1991 in Denver, Colorado.

Ostrander, G.K., J.J. Anderson, J. P. Fisher, M. L. Landolt and R. M. Kocan. 1990. Decreased performance of rainbow trout emergence behaviors following exposure to benzo(a)pyrene. Fishery Bull. 88:51-55.

Anderson, J.J. 1988. Diverting migrating fish past turbines. The Northwest Environmental Journal 4:109-128.

Anderson, J.J. 1988. A neural model for visual activation of startle behavior in fish. Journal of Theoretical Biology 131:289-305.

Anderson, J.J and A.H. Devol. 1987. The extent and intensity of the anoxic zone of basins and fords. Deep-Sea Research 34:927-944.

Craig L. Sommers

Water Resource Specialist

Craig is president of ERO Resources Corporation with over twenty years of consulting experience in land and water resources planning and evaluation. He serves as manager and lead scientist or economist on a wide variety of projects.

Some of Craig's experience includes: technical coordination in complex litigation, water rights and water resource evaluations, resource economics, soil surveys, arable land classification, land use planning, and agronomy.

Education

M.S. 1977, Agricultural Economics (Emphasis in Water Resources), University of California, Davis

B.S. 1976, Soil & Water Science, University of California, Davis

Representative Projects

Water Resources and Rights

- Gila River and Little Colorado River Adjudications, Salt River Project, Arizona—Technical advisor, overall coordination of staff and consultant efforts, water rights and economic analysis, member of negotiation team.
- Snake River Basin, Idaho Water Users—Evaluation of USBR water right transfer applications; technical input to negotiations; soil, arable land, hydrologic and economic evaluation of Indian and federal claims.
- Big Horn River Adjudication, State of Wyoming—Expert witness in soils, arable lands and agronomy, land use and land ownership evaluations, technical assistance in post-trial pleadings, state water right analysis.
- San Juan River Adjudication, State of New Mexico—Overall coordination and evaluation of state, federal and Indian water rights.
- Yakima River Adjudication, Yakima River Coalition, Washington—Technical coordination, water right analysis, and economic evaluations.
- Appraisals of water rights for clients in Arizona, Colorado, New Mexico, and Idaho.

Threatened and Endangered Species

- Snake/Columbia River Basins, Idaho Water Users—Economic and hydrologic analyses of critical habitat designations, agency decision documents, and recovery plans for threatened and endangered salmon and steelhead stocks.
- Rio Grande River, New Mexico State Engineer's Office—Economic analysis of critical habitat designation for the Rio Grande silvery minnow.

Environmental Impact & Assessment Permitting

- Soil, vegetation, wildlife, erosion control, economics, water quality or hydrology input to environmental impact statements and environmental assessments for Denver Water Department, City of Thornton, City of Aurora, City of Boulder, U.S. Forest Service, Winter Park Ski Area, Western Fuels Association and the Salt River Project in Colorado Utah, Wyoming and Arizona.

Natural Resources

- Soil surveys for the mining industry and federal agencies (BIA, BLM and Forest Service) in California, Colorado, Wyoming, New Mexico and Montana.
- Reclamation and Mine Plans in Wyoming, Utah and Colorado for UNC Mining and Milling Services, Inc., NERCO, Amoco Minerals (Cyprus Mines), Western Fuels Association, Tennessee Valley Authority and Geokinetics.

DAVID B. SHAW

Project Manager
Dave is an engineer who manages the Boise office for ERO Resources. His experience in water resources and management dates from 1974. He specializes in the identification, analysis, and resolution of water issues including coordination with other professionals in multi-disciplinary projects. Dave specializes in the following: surface and ground water supply and use studies, water rights evaluations, project management, alternative dispute resolution, expert witness testimony, and technical input on legislative and administrative matters.

Education
B.S. 1966, Agricultural Engineering, University of Idaho
M.S. 1972, Agricultural Engineering, University of Idaho

Project Experience
Water Resources

- Snake River Basin Adjudication (SRBA), ID—Program manager for identification and evaluation of 170,000 claims to water rights.
- Shoshone-Bannock Reserved Water Right Negotiation, ID—Co-chair of the state, Indian, federal and private technical advisory committee.
- First Water Distribution Rules Developed and Adopted in Idaho, Big Lost River Basin, ID— Team leader.
- Water Right Adjudications, ID—Designated by the SRBA court as an expert in water right adjudications.
- Department of Water Resources, Southwest Idaho-Western Region Manager.
- Department of Water Resources, Boise, ID— Technical Support Section Manager.
- Ground Water Recharge Water Right Approval, Big Lost River Basin, ID—Water Resource Negotiation/Expert.
- Water Quality Analysis for Water Users, Southwest ID—Project design, implementation and management.
- Evaluate Interaction of Canals on Ground Water, and Surface Water, Methow Valley, WA—Analysis of ground water/surface water supply.
- Evaluate Impact of Proposed Water Right Transfer on Irrigation District Water Supply, Boise River, ID—Identify and quantify changes to ground and surface water supply if transfer were approved.

RICHARD A. HINRICHSEN

Education

A.A.S., Music, 1982, Edmonds Community College
B.S., Mathematics, 1985, Central Washington University
M.S., Mathematical Sciences, 1987, Clemson University
Ph.D., Quantitative Ecology & Resource Management, 1994, University of Washington

Societies and Associations

American Fisheries Society
American Association for the Advancement of Science
The Shad Foundation, President

Presentations and Posters

Hinrichsen, R.A. 2000. The fight against variability: Are salmon and experimental management losing? 2000 Annual General Meeting. North Pacific International Chapter of the American Fisheries Society, Mt Vernon, Washington, April 10-12.

Hinrichsen, R.A. and C.C. Ebbesmeyer.1997.Epic shad invasions of the Columbia River from the 1870s onward. Resource Modeling Conference, University of Washington, Seattle, Washington, June 18.

Hinrichsen, R.A. and J.J. Anderson. 1994. Understanding the migratory behavior of juvenile chinook salmon (*Oncorhynchus tshawytscha*). contributed poster. Pacific Salmon & Their Ecosystems: Status & Future Options. Seattle, Washington, USA.

Hinrichsen, R.A. 1993. Optimal upstream migration timing of chinook salmon (*Oncorhynchus tshawytscha*). contributed paper. 1993 ESA annual meeting. Madison, Wisconsin, USA.

Hinrichsen, R.A. 1992. Optimal feeding and migration characteristics of ocean-type chinook salmon (*Oncorhynchus tshawytscha*). contributed paper. 1992 ESA annual meeting. Honolulu, Hawaii, USA.

Technical Reports and Papers

Hinrichsen, R. A. 2000. Are there scientific criteria for putting short-term conservation ahead of learning? No. Response to Kai N. Lee 1999: "Appraising Adaptive Management". Conservation Ecology 4(1): r7. [online] URL: http://www.consecol.org/vol4/iss1/resp7.

PATH. 2000. Preliminary Evaluation of the Learning Opportunities and Biological Consequences of Monitoring and Experimental Management Actions. Prepared by ESSA Technologies Ltd., Vancouver, BC, 150 pp.

PATH. 1999. Scoping of candidate research, monitoring and experimental management actions: concurrently reducing key uncertainties and recovering stocks. Working draft prepared by ESSA Technologies Ltd., Vancouver, BC, 232 pp.

Ingraham, W.J., C.C. Ebbesmeyer, and R.A. Hinrichsen. 1998. Imminent climate and circulation shift in Northeast Pacific Ocean could have major impact on marine resources. *EOS* Volume 79(6). page 197.

Ebbesmeyer,C.C. and R.A. Hinrichsen. 1997. The Oceanography of the Pacific Shad Invasion. *The Shad Journal*. Volume 2(1): pages 4-8.

Ebbesmeyer,C.C., R.A. Hinrichsen, and W.J. Ingraham. 1996. Spring and Fall wind transitions along the West coast of North America, 1900-1994. Presented at the PICES meeting, Nanaimo, British Columbia, 18 October 1996.

Hinrichsen, R.A. 1994. Optimization models for understanding migration behavior of juvenile chinook salmon. Ph.D. dissertation. University of Washington. Seattle, WA. USA.

Hinrichsen, R.A., T. Frever, J.J. Anderson, G. Swartzman and B. Sherer. 1991. Columbia River Salmon Passage (CRiSP) Model. Documentation for CRiSP.0. Center For Quantitative Science, University of Washington, Seattle, WA.

Hinrichsen, R.A. 1987. The Leslie model with harvesting. Master's thesis. Clemson University. Clemson, S.C. USA. 29p.

WILLIAM J. MCNEIL

Professor of Fisheries (Retired) and Fisheries Consultant

Oregon State University
Hatfield Marine Science Center
Newport, OR 97365
(503) 867-0100

1066 Westfarthing NW
Salem, OR 97304
(503) 362-9134
FAX (503) 362-0365

Education:

B.S. in fisheries, Oregon State University (1952); M.S. in fisheries,
Oregon State University (1956); Ph.D. in fisheries, University of Washington (1962)

Employment:

- Self-employed consultant resent);
- Professor, Coastal Oregon Marine Experiment Station (1990-1995);
- Professor of Fisheries and Director, Cooperative Institute for Marine Resources Studies, Oregon State University (1985-1990);
- General Manager, Oregon AquaFoods, Inc., Weyerhaeuser Co. (1976-1985);
- Program Manager, Alaska Salmon Investigations, National Marine Fisheries Service (1972-1976);
- Associate Professor Fisheries, Oregon State University (1966-1972);
- Supervisory Fishery Research Biologist, U.S. Bureau of Commercial Fisheries (1962-1966);
- Research Associate, Fisheries Research Institute, University of Washington (1956-1962)

Professional Recognition:

Lectures

- Norwegian Society for Aquaculture Research and Directorate for Nature Management (Norway) (1990);
- Washington State University (1988); Instituto Profesional de Osomo (Chile) (1987);
- Lewis and Clark College (1985, 1987, and 1989);
- University of Oregon (1980-1984);
- Portland State University (1983);
- Willamette University (1983);
- TINRO (USSR) (1976. 1978, and 1990);
- University of Alaska (1974-1976 and 1989).

Symposia

- Keynote Speaker, Fisheries Bioengineering Symposium (1988);
- Convenor, World Salmonid Conference (1986);

- Keynote Speaker, Salmonid Reproduction Symposium (1983);
- Convener, Panel on Ranching, World Mariculture Society (1982);
- Convener, Symposium on Salmonid Ecosystems of the North Pacific (1978);
- Steering Committee, North Pacific Aquaculture Symposium (1980); Steering Committee, World Technical Conference on Aquaculture (1976);
- Convener, Conference on Marine Aquaculture (1968).

Advisory and Executive Committees and Societies

- Scientific Advisory Committee for Prince William Sound (Alaska) Ecological Research Center (1989-present);
- Secretary, Oregon Governor's Salmon Advisory Committee (1981-1986);
- Advisor, Alaska Department of Commerce (1984 and 1985);
- Member, Bonneville Power Admin. Research Review Panels (1985 and 1989);
- Member, N.W. Power Planning Council Committee on Genetics Policies (1989);
- President, Oregon Chapter American Fisheries Society (1982 and 1983);
- Executive Committee, National Sea Grant Assoc. (1980-1983);
- Chairman, Governor's Alaska Fisheries Council (1975-1978).
- Chairman, Fisheries Technical Advisory Committee, Sheldon Jackson College (1974-1977);
- Advisor, National Academy of Sciences Committee on Aquaculture (1977);
- Fellow, American Institute of Fisheries Research Biologists (since 1972).

Consulting:

Client	Years	Topic
Washington Water Power	1992-1994	Dams and salmon in Clearwater River, ID
Direct Service Industries	Since 1989	Endangered Species Ac and salmon in the Columbia Basin
Yakima River Basin Coalition	Since 1989	Irrigation and salmon in Yakima River, WA
Grant County PUD	1989-1992	Passage of juvenile salmon at two mid Columbia River dams
Oregon Forest Industries Council	1991-1992	Forestry and salmon in the Pacific Northwest
Oregon Coastal Zone Management Assoc.	Since 1990	Restoration plan for Tillamook Bay, OR
Prince William Sound Aquaculture Corp.	1989-1990	Impact of Exxon Valdez oil spill on hatchery salmon
Pope Resources	1988-1989	Evaluation of Hood Canal/Fort Ludlow properties for aquaculture

Publications:

Approximately 80 published reports on subjects related to salmonids. The most recent publications are listed below:

McNeil, William J. 1984. Salmon ranching: a growing industry in the North Pacific. Oceanus 27 (1): 27-31.

McNeil, William J. 1985. Pink and chum salmon supply and outlook. Proceedings of the 1984 Pink and Chum Salmon Workshop, p. 186-190. Oceans and Fisheries, Canada.

McNeil, William J. and R.F. Severson. 1985. Impacts of ocean fisheries on natural and ranched stocks of Icelandic salmon. Fish Farming Symposium, Reykjavik, Iceland.

McNeil, William J. 1985. Comments on north Pacific fisheries Delphi project. *In* J. Yuska and N. Ridlington (editors). Seafood Quality and Product Form. Oregon Sea Grant ORESU-IN-85-004, p. 3-8.

McNeil, William J. 1987. Offshore transport and release of salmon smolts. Bonneville Power Administration Smolt Workshop, Kahneetah, Oregon.

McNeil, William J. (editor). 1988. Salmon Production, Management, and Allocation. Oregon State University Press, Corvallis, 194 pp.

McNeil, William J. 1988. Mariculture: an aid or hindrance to management. Trans. 53rd N.A. Wildl. & Nat. Res. Conf., p. 569-576.

McNeil, William J. 1989. Book review of Salmon and Trout Farming. Fisheries. 14: 57-58.

Kreeger, K, and W.J. McNeil. 1989. Estuarine dependence of juvenile chinook as it relates to salmon ranching. Northwest Environ. Jour. 5: 165-167.

McNeil, William J. 1989. Aquaculture and salmon ranching. *In* C.L. Smith (editor). Ocean Agenda 21. Oregon Sea Grant ORESU-B-89-001, p. 52-55.

McNeil, William J. In press. Future of salmon aquaculture. American Fisheries Society Symposium 10: 12-18.

McNeil, W.J., R. Gowan. and R. Severson. 1991. Offshore release of salmon smolts. American Fisheries Society. 10; 548-553.

McNeil, William J. 1991. Expansion of cultured Pacific salmon into marine ecosystems. Aquaculture. 98: 172-183.

McNeil, William J. 1991. Sea ranching of coho salmon (*Oncorhynchus kisutch*) in Oregon. pp. 1-10. *In* N. Pedersen and E. Kjorsvik (eds). Sea Ranching — Scientific Experiences and Challenges. Proceedings from the Symposium and Workshop on Sea Ranching. Norwegian Society for Aquaculture Research 21-23 October 1990, Bergen, Norway.

McNeil, W.J. 1995. Water velocity and migration of juvenile Salmon: Is faster necessarily better? Hydro Review 14(2): April 1995.